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JQuery/Node JS/Express JS

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How JavaScript works

- JavaScript is Single Threaded.

- A JavaScript engine exists in a single OS process and consumes a single thread.
- When the application is running, CPU execution is never performed in parallel,

since the JavaScript engine uses this method, it is impossible for users to get the Deadlocks and Race Conditions which actually makes Multi Threaded applications so complex.

Event loop

- An event loop is a construct that mainly performs two functions in a continuous loop
  - Event detection : In any run of the loop, it has to detect which events just happened.
  - Event handler triggering : When an event happens, the event loop must determine the event callback and invoke it.
- Event loop is just one thread running inside one process, which means that, when an event happens, the event handler can run without interruption

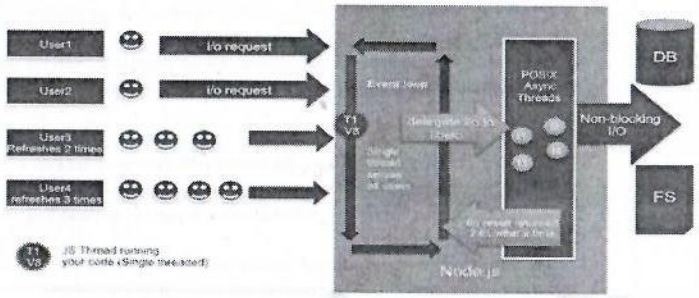
  - There is at most one event handler running at any given time
  - Any event handler will run to completion without being interrupted
- This allows the programmer to relax the synchronization requirements and not have to worry about concurrent threads of execution changing the shared memory state.

Stack, Heap and Queue

- Different browsers have different JavaScript engines (e.g. Chrome has V8, Firefox has OdinMonkey and IE has Chakra)
- JavaScript engine has three important features. They are Stack, Heap and Queue
- Each browser will implement these features differently, but all does the same.
- Stack
  - Currently running functions gets added to the stack(frame). Pops out from the once it completes its execution.

- Heap
  - Memory allocation happened here. It is a bunch of memory where object's live in a unordered manner.

- Queue
  - function calls are queued up which gets added to the stack once it is empty.



- Web-Socket server is created on a single thread—event loop which listens continuously on port 4000.
- When a web or app client connects to it, it fires the 'onConnection' event which the loop picks up and immediately publishes to the thread pool and is ready to receive the next request
- This is the main functionality differentiation between NodeJs based servers and other IIS/ Apache based servers, NodeJs for every connection request do not create a new thread instead it receives all request on single thread and delegates it to be handled by many background workers to do the task as required.
- Libuv library handles this workers in collaboration with OS kernel.
- Libuv is the magical library that handles the queueing and processing of asynchronous events utilizing powerful kernel, today most modern kernels are multi-threaded, they can handle multiple operations executing in the background.
- When one of these operations completes, the kernel tells Node.js so that the appropriate callback may be added to the poll queue to eventually be executed.

Introduction to Node.js

In 2009 Ryan Dahl created Node.js or Node, a framework primarily used to create highly scalable servers for web applications. It is written in C++ and JavaScript.

Node.js is a platform built on Chrome's JavaScript runtime(v8 JavaScript Engine) for easily building fast, scalable network applications.

It's a highly scalable system that uses asynchronous, non-blocking I/O model (input/output), rather than threads or separate processes

It is not a framework like jQuery nor a programming language like C# or JAVA . It's a new kind of web server like has a lot in common with other popular web servers, like Microsoft's Internet Information Services (IIS) or Apache

IIS / Apache processes only HTTP requests, leaving application logic to be implemented in a language such as PHP or Java or ASP.NET. Node removes a layer of complexity by combining server and application logic in one place.

Why Node.js?

JavaScript everywhere JavaScript.

i.e. Server-side and Client-side applications in

- Node is very easy to set up and configure.
- Vibrant Community
- Small core but large community so far we have 60,000 + packages on npm
- Real-time/ high concurrency apps (I/O bound)
- API tier for single-page apps and rich clients(iOS, Android)
- Service orchestration
- Top corporate sponsors like Microsoft, Joyent, PayPal etc..
- Working with NOSQL(MongoDB) Databases

Traditional Programming Limitations

In traditional programming I/O (database, network, file or inter-process communication) is performed in the same way as it does local function calls.

i.e. Processing cannot continue until the operation is completed.

When the operation like executing a query against database is being executed, the whole process/thread idles, waiting for the response. This is termed as "Blocking"

Due to this blocking behavior we cannot perform another I/O operation, the call stack becomes frozen waiting for the response.

We can overcome this issue by creating more call stacks or by using event callbacks.

Creating more call stacks

To handle more concurrent I/O, we need to have more concurrent call stacks.

Multi-threading is one alternative to this programming model.

– Makes use of separate CPU Cores as "Threads"

– Uses a single process within the Operating System

If the application relies heavily on a shared state between threads accessing and modifying shared state increase the complexity of the code and It can be very difficult to configure, understand and debug.

Event-driven Programming

Event-driven programming or Asynchronous programming is a programming style where the flow of execution is determined by events.

Events are handled by event handlers or event callbacks

An event callback is a function that is invoked when something significant happens like when the user clicks on a button or when the result of a database query is available

```
query_finished =
    function(result) {
    do_something_with(res
    ult);
}
query('SELECT Id,Name FROM employees', query_finished);
```

- Now instead of simply returning the result, the query will invoke the query_finished function once it is completed.
- Node.js supports Event-driven programming and all I/O in Node are non-Blocking
- A module is the overall container which is used to structure and organize code.
- It supports private data and we can explicitly defined public methods and variables (by just adding/removing the properties in return statement) which lead to increased readability.
- JavaScript doesn't have special syntax for package / namespace, using module we can create self-contained decoupled pieces of code.
- It avoids collision of the methods/variables with other global APIs.
- In Node, modules are referenced either by file path or by name.
- Node's core modules expose some Node core functions(like global, require, module, process, console) to the programmer, and they are preloaded when a Node process starts.
- To use a module of any type, we have to use the require function. The require function returns an object that represents the JavaScript API exposed by the module.
  - var module = require('module_name');
- Modules can be referenced depending on which kind of module it is.
- Loading a core module
  - Node has several modules compiled into its binary distribution. These are called the core modules. It is referred solely by the module name, not by the path and are preferentially loaded even if a third-party module exists with the same name.
    - var http = require('http');
- Loading a file module (User defined module)
  - We can load non-core modules by providing the absolute path / relative path. Node will automatically adding the .js extension to the module referred.
    - var myModule = require('d:/Rojrocks/nodejs/module'); // Absolute path for module.js
    - var myModule = require('../module'); // Relative path for module.js (one folder up level)
    - var myModule = require('./module'); // Relative path for module.js (Exists in current directory)

- Loading a folder module (User defined module)
  - We can use the path for a folder to load a module.
    - var myModule = require('./myModuleDir');
  - Node will presume the given folder as a package and look for a package definition file inside the folder. Package definition file name should be named as pagkage.json
  - Node will try to parse package.json and look for and use the main attribute as a relative path for the entry point.

  - We need to use npm init command to create package.json.
    - Creating Package.json using npm init command D:\Rojrocks\mynodejsApp> npm init

```
{ "name": "Rojrocks_Modules", "version": "1.0.0",
"description": "Rojrocks Modules for Demo", "main": "index.js",
"scripts": { "test": "echo \"Error: no test specified\" && exit 1" }, "author": "Rojrocks M
<Rojrocks.khadilkar@KLFS.com>", "dependencies":{ }
"devdependencies:{ }
"license": "ISC"}
```

    - var myModule = require('d:/Rojrocks/ mynodejsApp'); // refer index.js placed in modules folder.

package.json usage

- package.json is a configuration file from where the npm can recognize dependencies between packages and installs modules accordingly.
- It must be located in project's root directory.
- The JSON data in package.json is expected to adhere to a certain schema. The following fields are used to build the schema for package.json file
  - name and version : package.json must be specified at least with a name and version for package. Without these fields, npm cannot process the package.
  - description and keywords : description field is used to provide a textual description of package. Keywords field is used to provide an array of keywords to further describe the package. It is used by npm search command
  - author : The primary author of a project is specified in the author field.
  - main : Instruct Node to identify its main entry point.

- dependencies : Package dependencies are specified in the dependencies field.
- devdependencies : Many packages have dependencies that are used only for testing and development. These packages should not be included in the dependencies field. Instead, place them in the separate devdependencies field.
- scripts : The scripts field, when present, contains a mapping of npm commands to script commands. The script commands, which can be any executable commands, are run in an external shell process. Two of the most common commands are start and test. The start command launches your application, and test runs one or more of your application's test scripts.

Node Package Manager

- Loading a module(Third party) installed via NPM (Node Package Manager)
- Apart from writing our own modules and core modules, we will frequently use the modules written by other people in the Node community and published on the Internet (npmjs.com).
- We can install those third party modules using the Node Package Manager which is installed by default with the node installation.
- To install modules via npm use the npm install command.
- npm installs module packages to the node_modules folder.
- To update an installed package to a newer version use the npm update command.
- If the module name is not relative and is not a core module, Node will try to find it inside the node_modules folder in the current directory.
- var jade = require('jade');
- Here jade is not a core module and not available as a user defined module found in relative path, it will look into the node_modules/jade/package.json and refer the file/ folder mentioned in main attribute.

- Creating a module that exposes / exports a function called helloWorld

```
// Save it as myModule.js
exports.helloWorld = function () {
    console.log("Hello World");
}
```

- exports object is a special object created by the Node module system which is returned as the value of the require function when you include that module.
- Consuming the function on the exports object created in myModule.js

```
// Save it as moduleTest.js
var module = require('./myModule'); module.helloWorld();
```

- We can replace exports with module.exports
- exports = module.exports = { }

```
var myVeryLongInternalName = function() { ... };
exports.shortName = myVeryLongInternalName;
// add other objects,
functions, as required
followed by:

var m = require('./mymodule');

m.shortName(); // invokes module.myVeryLongInternalName
```

- JavaScript doesn't have a byte type. It just has strings.
- Node is based on JavaScript with just using string type it is very difficult to perform the operations like communicate with HTTP protocol, working with databases, manipulate images and handle file uploads.
- Node includes a binary buffer implementation, which is exposed as a JavaScript API under the Buffer pseudo-class.
- Using buffers we can manipulate, encode, and decode binary data in Node. In node each buffer corresponds to some raw memory allocated outside V8.
- A buffer acts like an array of integers, but cannot be resized
- new Buffer(n) is used to create a new buffer of 'n' octets. One octet can be used to represent decimal values ranging from 0 to 255.

- There are several ways to create new buffers.
- new Buffer(n) : To create a new buffer of 'n' octets
- var buffer = new Buffer(10);
- new Buffer(arr) : To create a new buffer, using an array of octets.
- var buffer = new Buffer([7,1,4,7,0,9]);
- new Buffer(str,[encoding]) : To create a new buffer, using string and encoding.
- var buffer = new Buffer("KLFS","utf-8"); // utf-8 is the default encoding in Node.

- Writing to Buffer
- buf.write(str, [offset], [length], [encoding]) method is used to write a string to the buffer.
- buf.write() returns the number of octets written. If there is not enough space in the buffer to fit the entire string, it will write a part of the string.
- An offset or the index of the buffer to start writing at. Default value is 0.
- Reading from buffers
- buf.toString([encoding], [start], [end]) method decodes and returns a string from buffer data.
- buf.toString() returns method reads the entire buffer and returns as a string.
- buf.toJSON() method is used to get the JSON-representation of the Buffer instance, which is identical to the output for JSON Arrays.

Event handling

- In node there are two event handling techniques. They are called callbacks and EventEmitter.
- Callbacks are for the async equivalent of a function. Any async function in node accepts a callback as it's last parameter

```
var myCallback = function(data) {
  console.log('got data: '+data);
};

var fn = function(callback) {
    callback('Data from Callback');
};

fn(myCallback);
```

- In node.js an event can be described simply as a string with a corresponding callback and it can be emitted.
- The on or addListener method allows us to subscribe the callback to the event.
- The emit method "emits" event, which causes the callbacks registered to the event to trigger.

```
var events = require('events');
var eventEmitter = new events.EventEmitter();var myCallback = function(data) {
    console.log('Got data: '+data);
};
eventEmitter.on('RojrocksEvent', myCallback);
var fn = function() { eventEmitter.emit('RojrocksEvent','Data from Emitter');
};
fn();
```

- All objects which emit events in node are instances of events.EventEmitter which is available inside Event module.
- We can access the Event module using require("events")
- addListener(event, listener) / on(event, listener)
  - Adds a listener to the end of the listeners array for the specified event. Where listener is a function which needs to be executed when an event is emitted.
- once(event, listener)
  - Adds a one time listener for the event. This listener is invoked only the next time the event is fired, after which it is removed.
- removeListener(event, listener)
  - Remove a listener from the listener array for the specified event
- removeAllListeners([event])
  - Removes all listeners, or those of the specified event
- We can create Event Emitter and customevents

```
var EventEmitter = require('events').
Var eventEmmiter=new events.EventEmitter();
//event handler function

var mycallback = function(data){ console.log(data);
}
//configure the event
eventEmitter.on('RojRocksEvent',mycallback);

//emit will generate event
Var fn = function() { evenEmitter.emit('RojRocksEvent', 'Data from fn function');
}
fn();
```

File System Module

- By default Node.js installations come with the file system module.
- This module provides a wrapper for the standard file I/O operations.
- We can access the file system module using

```
require("fs")
```

- All the methods in this module has
- asynchronous forms
- synchronous forms.
- synchronous methods in this moduleends with 'Sync'. For instance renameSync is the synchronous method for rename asynchronous method.
- The asynchronous form always take a completion callback as its last argument.
- The arguments passed to the completion callback depend on the method,
- but the first argument is always reserved for an exception.
- If the operation was completed successfully, then the first argument will be null or undefined.
- When using the synchronous form any exceptions are immediately thrown. You can use try/catch to handle exceptions or allow them to bubble up.
- fs.stat(path, callback)
  - Used to retrieve meta-info on a file or directory.
- fs.readFile(filename, [options], callback)
  - Asynchronously reads the entire contents of a file.

- fs.writeFile(filename, data, [options], callback)
  - Asynchronously writes data to a file, replacing the file if it already exists. Data can be a string or a buffer.
- fs.unlink(path, callback)
  - Asynchronously deletes a file.
- fs.watchFile(filename, [options], listener)
  - Watch for changes on filename. The callback listener will be called each time the file is accessed. Second argument is optional by default it is { persistent: true, interval: 5007 }. The listener gets two arguments the current stat object and the previous stat object.

- fs.exists(path, callback)
  - Test whether or not the given path exists by checking with the file system. The callback argument assigned with either true or false based on the existence.
- fs.rmdir(path, callback)
  - Asynchronously removes the directory.
- fs.mkdir(path, [mode], callback)
  - Asynchronously created the directory.
- fs.open(path, flags, [mode], callback)
  - Asynchronously open the file.
- fs.close(fd, callback)
  - Asynchronously closes the file.
- fs.read(fd, buffer, offset, length, position, callback)
  - Read data from the file specified by fd.

```
var fs=require('fs');
fs.readFile('./demo.txt', "utf-8", function (err, data) { if (err) console.log("error");
console.log(data);
});

console.log("Program ends here"); console.log("Program ends here123");

var fs=require('fs');
var content = fs.readFileSync('./demo.txt', "utf-8"); console.log(content);
console.log("program ends here");
var fs = require("fs");
var path =      dirname + "/sample.txt"; fs.stat(path, function(error, stats) {
        //open file in read mode
        fs.open(path, "r", function(error, fd) {
                //create buffer of file size
                var buffer = new Buffer(stats.size);
                //read file and store contents in buffer fs.read(fd, buffer, 0, buffer.length, null,
                function(error, bytesRead, buffer) {
                        var data = buffer.toString("utf8");
                        console.log(data);
                });
        });
});
console.log('program ends here');
```

Read file line by line

- Node.js provides a built-in module readline that can read data from a readable stream.
- It emits an event- "line" whenever the data stream encounters an end of line character (\n, \r, or \r\n).
- Readline Module

The readline module is inbuilt into Node, so you don't need to install any third party module

- A special thing to note is that the readline module reads from a stream rather than bufferring the whole file in memory (read Node.js Streams). That is why the createReadStream method is used.

```
var fs = require("fs");
var path =      dirname + "/sampleout.txt";
var data = "This data will be written in the file";
//open file it will assign fd fs.open(path, "w", function(error, fd) {
//data will be stored in the buffer var buffer = new Buffer(data);
//buffer contents will be written in the file fs.write(fd, buffer, 0, buffer.length, null,
function(error, written, buffer) { if (error) {
console.error("write error: " + error.message);
} else {
console.log("Successfully wrote "     + written + " bytes.");
});
}
});

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

// create instance of readline
// each instance is associated with single input stream let rl = readline.createInterface({
input: fs.createReadStream('products.txt')
});

let line_no = 0;

// event is emitted after each line rl.on('line', function(line) {
line_no++; console.log(line);
});
```

```
// end
rl.on('close', function(line) { console.log('Total lines : ' + line_no);
});
```

- A stream is an abstract interface implemented by various objects in Node. They represent inbound (ReadStream) or outbound (WriteStream) flow of data.
- Streams are readable, writable, or both (Duplex).
- All streams are instances of EventEmitter.
- Stream base classes can be loaded using require('stream')
- ReadStream is like an outlet of data, once it is created we can wait for the data, pause it, resume it and indicates when it is actually end.
- WriteStream is an abstraction on where we can send data to. It can be a file or a network connection or even an object that outputs data that was transformed(when zipping a file)

- ReadStream is like an outlet of data, which is an abstraction for a source of data that you are reading from
- A Readable stream will not start emitting data until you indicate that you are ready to receive it.
- Readable streams have two "modes": a flowing mode and a non-flowing mode.
  - In flowing mode, data is read from the underlying system and provided to your program as fast as possible.
  - In non-flowing mode, you must explicitly call stream.read() to get chunks of data out.
- Readable streams can emit the following events
  - 'readable' : This event is fired when a chunk of data can be read from the stream.
  - 'data' : This event is fired when the data is available. It will switch the stream to flowing mode when it is attached. It is the best way to get the data from stream as soon as possible.

  - 'end' : This event is fired when there will be no more data to read.
  - 'close' :Emitted when the underlying resource (for example, the backing file descriptor) has been closed. Not all streams will emit this.
  - 'error' : Emitted if there was an error receiving data.
- Readable streams has the following methods
  - readable.read([size]) : Pulls data out of the internal buffer and returns it. If there is no data available, then it will return null.
  - readable.setEncoding(encoding) : Sets the encoding to use.
  - readable.resume() : This method will cause the readable stream to resume emitting data events.
  - readable.pause() : This method will cause a stream in flowing-mode to stop emitting data events. Any data that becomes available will remain in the internal buffer.
  - readable.pipe(destination, [options]) : Pulls all the data out of a readable stream and writes it to the supplied destination, automatically managing the flow.

- Writable stream interface is an abstraction for a destination that you are writing data to.
- Writable streams has the following methods

  - writable.write(chunk, [encoding], [callback]) : This method writes some data to the underlying system and calls the supplied callback once the data has been fully handled. Here chunk is a String / Buffer data to write
  - writable.end([chunk], [encoding], [callback]) : Call this method when no more data will be written to the stream. Here chunk String / Buffer optional data to write
- Writable streams can emit the following events
  - 'drain' : If a writable.write(chunk) call returns false, then the drain event will indicate when it is appropriate to begin writing more data to the stream.
  - 'finish' : When the end() method has been called, and all data has been flushed to the underlying system, this event is emitted

1.6 : Working with File System & Streams

Writable Stream

- 'pipe' : This is emitted whenever the pipe() method is called on a readable stream, adding this writable to its set of destinations.
- 'unpipe' : This is emitted whenever the unpipe() method is called on a readable stream, removing this writable from its set of destinations.
- 'error' : Emitted if there was an error when writing or piping data.

Creating big file

```
const fs = require('fs');
const file = fs.createWriteStream('./big.file');

for(let i=0; i<= 1e6; i++) {
file.write('Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.\n');
}

file.end();

const fs = require('fs');
const server = require('http').createServer();

server.on('request', (req, res) => { fs.readFile('./big.file', (err, data) => { if (err) throw err;

res.end(data);
});
});
server.listen(8000);
```

This will store the data in buffer i.e in the memory, so cannot read files with size greater than RAM size

Better to use pipe command

readableSrc.pipe(writableDest)
When we ran the server, it started out with a normal amount of memory, 8.7 MB:
the memory consumption jumped to 434.8 MB.

```
const fs = require('fs');
const server = require('http').createServer();

server.on('request', (req, res) => {
const src = fs.createReadStream('./big.file'); src.pipe(res);
});

server.listen(8000);
```

When a client asks for that big file, we stream it one chunk at a time, which means
we don't buffer it in memory at all. The memory usage grew by about 25 MB and that's it.

HTTP module in Node.js

- We can easily create an HTTP server in Node.
- To use the HTTP server and client one must require('http').
- The HTTP interfaces in Node are designed to support many features of the protocol which have been traditionally difficult to use. In particular, large, possibly chunk-encoded, messages.
- Node's HTTP API is very low-level. It deals with stream handling and message parsing only. It parses a message into headers and body
- HTTP response implements the Writable Stream interface and request implements Readable Stream interface.

Create http server

```
/* Loading http module*/
var http = require('http');

/* Returns a new web server object*/
var server = http.createServer(function(req,res){

/* Sends a response header to the request.*/
res.writeHead(200,{'content-type':'text/html'});

/*sends a chunk of the response body*/ res.write('<h1>Hello KLFS</h1>')

/* signals server that all the responses has been sent */
res.end('<b>Response Ended</b>')

});

/* Accepting connections on the specified port and hostname. */
server.listen(3000);

console.log('server listening on localhost:3000');
```

Routing

Routing refers to the mechanism for serving the client the content it has asked

```
var http = require('http');
var server = http.createServer(function(req,res){
var path = req.url.replace(/\/?(?:\?.*)?$/, '').toLowerCase(); switch(path) {
case '' :
res.writeHead(200, {'Content-Type': 'text/html'});
res.end('<h1>Home Page</h1>'); break;
case '/about' :
res.writeHead(200, {'Content-Type': 'text/html'}); res.end('<h1>About us</h1>');
break;

});
default:
 res.writeHead(404, { 'Content-Type': 'text/plain' }); res.end('Not Found');
break;
 }
});
server.listen(3000);
}
```

Accept data through form form.html

```
<!doctype html>
    <html>
    <body>
      <form action="/calc" method="post">
        <input type="text" name="num1" /><br />
        <input type="number" name="num2" /><br />

        <button type="submit">Save</button>
      </form>
    </body>
    </html>
```

Accept data from user through form

```
var http=require("http"); var fs=require("fs");
var url=require("url");
var query=require("querystring");
//add user defined module
var m1=require("./formaddmodule");
//function to handle request and response
 function process_request(req,resp)
{
//to parse url to separate path
var u=url.parse(req.url); console.log(u);
//response header
resp.writeHead(200,{'Content-Type':'text/html'});



//routing info
 switch(u.pathname){
case '/':
// read data from html file
fs.readFile("form.html",function(err,data){
if(err){
        resp.write('some error'); console.log(err);
});
break;

}else{
// write file data to response
resp.write(data);
//send response to client resp.end();}
case '/calc':
var str="";
//data event handling while receiving data
req.on('data',function(d){
str+=d;});
//end event when finished receiving data
req.on('end',function(){
console.log(str);
var ob=query.parse(str);
//calling user defined function from user module
var sum=m1.add(ob.num1,ob.num2);
resp.end("<h1>Addition : "+sum+"</h1>");
});

}

}
var server=http.createServer(process_request);
server.listen(3000);

Forms and modules
Formaddmodule.js
exports.add=function(a,b){

return parseInt(a)+parseInt(b);

}
```

- If we try to create apps by only using core Node.js modules we will end up by writing the same code repeatedly for similar tasks such as

  - Parsing of HTTP request bodies
  - Parsing of cookies
  - Managing sessions
  - Organizing routes with a chain of if conditions based on URL paths and HTTP methods of the requests
  - Determining proper response headers based on data types
- Developers have to do a lot of manual work themselves, such as interpreting HTTP methods and URLs into routes, and parsing input and output data.
- Express.js solves these and many other problems using abstraction and code organization.

Working with Express framework

- Express.js is a web framework based on the core Node.js http module and Connect components
- Express.js framework provides a model-view-controller-like structure for your web apps with a clear separation of concerns (views, routes, models)
- Express.js systems are highly configurable, which allows developers to pick freely whatever libraries they need for a particular project
- Express.js framework leads to flexibility and high customization in the development of web applications.
- In Express.js we can define middleware such as error handlers, static files folder, cookies, and other parsers.
- Middleware is a way to organize and reuse code, and, essentially, it is nothing more than a function with three parameters: request, response, and next.

Connect module

- Connect is a module built to support interception of requests in a modular approach.

```
var logger = function(req, res, next) {
    console.log(req.method, req.url);
    next();
};
var helloWorld = function(req, res, next) {
    res.setHeader('Content-Type', 'text/plain');
    res.end('Hello World');
};
app.use(logger);
app.use('/hello',helloWorld);
app.listen(3000);
console.log('Server running at localhost:3000');
```

Express.js Installation

- The Express.js package comes in two flavors:

- express-generator: a global NPM package that provides the command-line tool for rapid app creation (scaffolding)
- express: a local package module in your Node.js app's node_modules folder

Package.json

```
{ "name": "myapp",
"version": "1.0.0",
"description": "This is description",
"main": "index.js",
"scripts": {    "test": "echo \"Error: no test specified\" && exit 1" },

"devDependencies":{ },
"keywords"
: [    "asd",  "sdjl",  "ljdfljsd",    "kjdflkjlkj" ],
 "author": "Kishori",
"license": "ISC"}
```

To install if package.json file in myapp folder C:/...../myapp>npm install

App.js is the main file in Express framework. A typical structure of the main Express.js file consists of the following areas

- 1. Require dependencies
- 2. Configure settings
- 3. Connect to database (optional)
- 4. Define middleware
- 5. Define routes
- 6. Start the server

Routes are processed in the order they are defined. Usually, routes are put after middleware, but some middleware may be placed following the routes. A good example of such middleware, found after a routes, is error handler.

The way routes are defined in Express.js is with helpers app.VERB(url, fn1, fn2, ..., fn), where fnNs are request handlers, url is on a URL pattern in RegExp, and VERB values are as follows:

- all: catch every request (all methods)
- get: catch GET requests
- post: catch POST requests
- put: catch PUT requests
- del: catch DELETE requests

The order here is important, because requests travel from top to bottom in the chain of middleware.

Finally to start the server, using express object

```
var express=require("express");
 var app=express();
app.listen(3000, function(){
console.log('Express server listening on port ' + app.get('port'));
});
```

Handling post request

POST request

```
var express=require("express"); var app=express();
var bodyparser=require("body-parser");

app.use(bodyparser.urlencoded({extended:false}));
app.use(function(req,resp,next){
console.log(req.method+"      "+req.url);
next();
});
app.get("/",function(req,resp){
resp.sendFile("form.html",{root:dirname});
});
app.post("/calc",function(req,resp){
resp.send("<h1>"+req.body.num1+"  "+req.body.num2+"</h1>");
});

app.listen(2000);


//import the express module
var express = require('express');

//store the express in a variable var app = express();

//allow express to access our html (index.html) file
 app.get('/index.html', function(req, res) {
res.sendFile(    dirname + "/" + "index.html");
});
```

Handling GET request in express

Handling Get Request

```
app.get('/user', function(req, res){ response = {
first_name : req.query.first_name,
last_name : req.query.last_name,
gender: req.query.gender
};
```

User-info.html

```
<html>
 <head>
   <title>Basic User Information</title>
 </head>
 <body>
   <form action="http://localhost:8888/process_get"
        method="GET">First Name: <input type="text"
        name="first_name"> <br>
```

```
                Last Name: <input type="text"
                  name="last_name"> <br>Gender: <select
                  name="gender">
                        <option value="Male">Male</option>
                        <option value="Female">Female</option>
                      </select>
                    <input type="submit" value="submit">
            </form>
        </body>
    </html>

    //route the GET request to the specified path, "/user".
    //This sends the user
    information to the path
    app.get('/user',
    function(req, res){
        response = {
            first_name :
            req.query.first_na
            me,last_name :
            req.query.last_na
            me, gender:
            req.query.gender
            };
        //this line is optional and will print the response on the command prompt
        //It's useful so that we know what infomration is being transferred
        //using the server
        console.log(response);
        //convert the
        response in JSON
        format
        res.end(JSON.stringi
        fy(response));
    });
//This piece of code creates the server
//and listens to the request at port 8888
//we are also generating a message once the
//server is created
var server = app.listen(8888, function(){
 var host = server.address().address;
var port = server.address().port;
console.log("Example app listening at http://%s:%s", host, port);
});
```

Steps for creating Express.js Application

- Step – 1 : Create a folder named MyApp
- Step – 2 : Create package.json with the following schema

```
{
  "name": "MyApp",
  "version": "1.0.0",
  "description": "My first express js Application",
  "main": "app.js",
  "dependencies": {
    "body-parser": "1.10.1",
    "cookie-parser": "1.3.3",
var express = require('express');
var http = require('http');
var path = require('path');

var app = express();

app.set('port', process.env.PORT || 3000);
app.set('views', path.join(__dirname, 'views'));
app.set('view engine', 'jade');

app.all('*', function(req, res) {
    res.render('index',{title: 'KLES services expressjs training'});
});

http.createServer(app).listen(app.get('port'),function(){
    console.log('Express.js server listening on port ' +app.get('port'));
});
```

- public/scripts : Scripts
- db : Seed data and scripts for MongoDB
- views : Jade (or any other template engine) files
- views/includes : Partial / include files
- routes : Node.js modules that contain request handlers

- Step – 5 : Create the main file named app.js

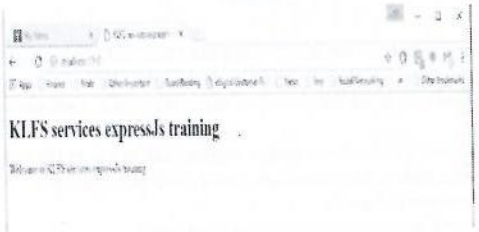
Step – 6 : Type the following contents in app.js

Step – 7 : Create index.jade under views folder and type the following contents

```
doctype html
html
    head
        title= title
    body
        h1= title
        p Welcome to #{title}
```

Step – 8 : Start the app by typing npm start in command prompt.

Step – 9 : Open browser and type http://localhost:3000 to view the SampleApp



application object properties & methods

Property/Method	Description
`app.set(name, value)`	Sets app-specific properties
`app.get(name)`	Retrieves value set by `app.set()`
`app.enable(name)`	Enables a setting in the app
`app.disable(name)`	Disables a setting in the app
`app.enabled(name)`	Checks if a setting is enabled
`app.disabled(name)`	Checks if a setting is disabled
`app.configure([env], callback)`	Sets app settings conditionally based on the development environment
`app.use([path], function)`	Loads a middleware in the app
`app.engine(ext, callback)`	Registers a template engine for the app
`app.param([name], callback)`	Adds logic to route parameters
`app.VERB(path, [callback...], callback)`	Defines routes and handlers based on HTTP verbs
`app.all(path, [callback...], callback)`	Defines routes and handlers for all HTTP verbs
`app.locals`	The object to store variables accessible from any view
`app.render(view, [options], callback)`	Renders view from the app
`app.routes`	A list of routes defined in the app
`app.listen()`	Binds and listen for connections

request object properties & methods

Property/Method	Description
`req.params`	Holds the values of named routes parameters
`req.params(name)`	Returns the value of a parameter from named routes or GET params or POST params
`req.query`	Holds the values of a GET form submission
`req.body`	Holds the values of a POST form submission
`req.files`	Holds the files uploaded via a form
`req.route`	Provides details about the current matched route
`req.cookies`	Cookie values
`req.signedCookies`	Signed cookie values
`req.get(header)`	Gets the request HTTP header
`req.accepts(types)`	Checks if the client accepts the media types
`req.accepted`	A list of accepted media types by the client
`req.is(type)`	Checks if the incoming request is of the particular media type

Property/Method	Description
`req.ip`	The IP address of the client
`req.ips`	The IP address of the client, along with that of the proxies it is connected through
`req.stale`	Checks if the request is stale
`req.xhr`	Checks if the request came via an AJAX request
`req.protocol`	The protocol used for making the request
`req.secure`	Checks if it is a secure connection
`req.subdomains`	Subdomains of the host domain name
`req.url`	The request path, along with any query parameters
`req.originalUrl`	Used as a backup for `req.url`
`req.acceptedLanguages`	A list of accepted languages by the client
`req.acceptsLanguage(langauge)`	Checks if the client accepts the language
`req.acceptedCharsets`	A list of accepted charsets by the client
`req.acceptsCharsets(charset)`	Checks if the client accepts the charset
`req.host`	Hostname from the HTTP header

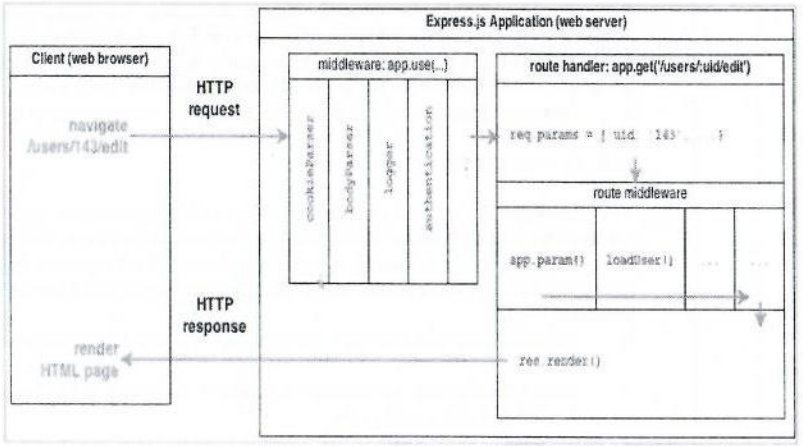
response object properties & methods

Property/Method	Description
`res.jsonp([status|body], [body])`	Sends a JSON object for HTTP response with JSONP support, along with an optional HTTP response code
`res.type(type)`	Sets the media type HTTP response header
`res.format(object)`	Sends a response conditionally, based on the request HTTP Accept header
`res.attachment([filename])`	Sets response HTTP header Content-Disposition to attachment
`res.sendfile(path, [options], [callback])`	Sends a file to the client
`res.download(path, [filename], [callback])`	Prompts the client to download a file
`res.links(links)`	Sets the HTTP Links header
`res.locals`	The object to store variables specific to the view rendering a request
`res.render(view, [locals], callback)`	Renders a view

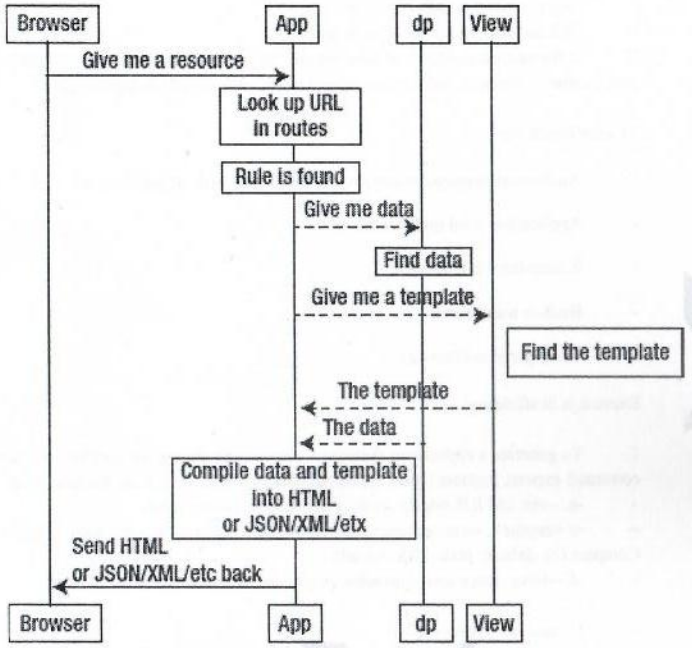
How Express.js works

- Express.js usually has an entry point, a main file. Most of the time, this is the file that we start with the node command or export as a module. In the main file we do the following
  - Include third-party dependencies as well as our own modules, such as controllers, utilities, helpers, and models
  - Configure Express.js app settings such as template engine and its file extensions
  - Connect to databases such as MongoDB, Redis, or MySQL (optional)
  - Define middlewares and routes
  - Start the app and Export the app as a module (optional)
- When the Express.js app is running, it's listens to requests. Each incoming request is processed according to a defined chain of middleware and routes, starting from top to bottom.

How Express.js works



Request flow in Express



Request flow in Express

- In Express server the request flow will be :
- Route □ Route Handler □ Template □ HTML
- The route defines the URL schema. It captures the matching request and passed on control to the corresponding route handler
- The route handler processes the request and passes the control to a template.
- The template constructs the HTML for the response and sends it to the browser.
- The route handler need not always pass the control to a template, it can optionally send the response to a request directly.

Using middleware

- A middleware is a JavaScript function to handle HTTP requests to an Express app.
- It can manipulate the request and the response objects or perform an isolated action, or terminate the request flow by sending a response to the client, or pass on the control to the next middleware.
- A middleware can:
  - Execute any code.
  - Make changes to the request and the response objects.

- End the request-response cycle.
- Call the next middleware in the stack.

If the current middleware does not end the request-response cycle, it must call next() to pass control to the next middleware, otherwise the request will be left hanging.

Types of middleware

An Express application can use the following kinds of middleware:

- Application-level middleware
- Router-level middleware
- Built-in middleware
- Third-party middleware

Express.js Scaffolding

To generate a application skeleton for Express.js app, we need to run a terminal command express [options] [dir | appname] the options for which are the following:

- -e, --ejs: add EJS engine support (by default, Jade is used)
- -c <engine>, --css <engine>: add stylesheet <engine> support, such as LESS, Stylus or Compass (by default, plain CSS is used)
- -f, --force: force app generation on a nonempty directory

- C:\myapp> express –e –f

Unit Testing, Logging & Debugging

Unit Testing is nothing but breaking down the logic of application into small chunks or 'units' and verifying that each unit works as we expect.

Unit Testing the code provides the following benefits :

- Reduce code-to-bug turn around cycle
- Isolate code and demonstrate that the pieces function correctly
- Provides contract that the code needs to satisfy in order to pass
- Improves interface design

Unit testing can be done in 2 ways

- Test-Driven Development
- Test-After Development

Test-Driven Development

In Test Driven Development (TDD) automated unit tests are written before the code is actually written. Running these tests give you fast confirmation of whether your code behaves as it should.

TDD can be summarized as a set of the following actions:

1. Writing a test : In order to write the test, the programmer must fully comprehend the requirements. At first, the test will fail because it is written prior to the feature
2. Run all of the tests and make sure that the newest test doesn't pass : This insures that the test suite is in order and that the new test is not passing by accident, making it irrelevant.
3. Write the minimal code that will make the test pass : The code written at this stage will not be 100% final, it needs to be improved at later stages. No need to write the perfect code at this stage, just write code that will pass the test.

4. Make sure that all of the previous tests still pass: If all tests succeeds, developer can be sure that the code meets all of the test specifications and requirements and move on to the next stage.
5. Refactor code : In this stage code needs to be cleaned up and improved. By running the test cases again, the programmer can be sure that the refactoring / restructuring has not damaged the code in any way.
6. Repeat the cycle with a new test : Now the cycle is repeated with another new test.

Using TDD approach, we can catch the bugs in the early stage of development

It works best with reusable code

Test-After Development

In Test-After Development, we need to write application code first and then write unit test which tests the application code.

TAD approach helps us to find existing bugs

It drives the design

It is a part of the coding process

Enables Continual progress and refactoring

It defines how the application is supposed to behave.

Ensures sustainable code

Behavior-Driven Development

Test-Driven Development (TDD) focus on testing where as Behavior-Driven Development (BDD) mainly concentrates on specification.

In BDD we write test specifications, not the tests which we used to do in TDD i.e. no need focus anymore on the structure of the source code, focus lies on the behavior of the source code

In BDD we need to follow just one rule. Test specifications which we write should follow Given-When-Then steps

It is very easy to write / read and understand the test specifications, because BDD follows a common vocabulary instead of a test-centered vocabulary (like test suite, test case, test …)

BDD is a specialized version of TDD that specifies what needs to be unit-tested from the perspective of business requirements.

Story: As a registered user, need to login in to the system to access home page. If username or password are invalid, they will stay in login page and the system will shows an error message.

Scenario: Valid Login
Given The user is in login page
And the user enters a valid username And the user enters a valid password When the user logs in
Then the user is redirected to Home page

Scenario: Enter an Invalid password
Given The user is in login page
And the user enters a valid username And the user enters a invalid password When the user logs in
Then the user is redirected to the Login Page
And the System shows the following message : "Invalid username or password"

Unit Testing in Node

- In Node there are numerous tools / testing frameworks are available to achieve the objective of having well tested quality code.
- Mocha, Chai and SuperTest integrates very well together in a natural fashion
- Mocha is a testing framework which follows Behavior-driven Development (BDD) interface makes our tests readable and make us very clear what is being tested.
- Mocha allows to use any assertion library like (chai, should.js, expect.js)
- Chai is a BDD / TDD assertion library for node and the browser that can be delightfully paired with any testing framework like Mocha.
- SuperTest is a HTTP testing library which has a bunch of convenience methods for doing assertions on headers, statuses and response bodies. If the server is not already listening for connections then it is bound to an ephemeral port, so there is no need to keep track of ports.

Mocha

- Mocha is a mature and powerful testing framework for Node.js.
- It is more robust and widely used. NodeUnit, Jasmine and Vows are the other alternatives.
- Mocha supports both BDD interface's like (describe, it, before) and traditional TDD interfaces (suite, test, setup).
- We need explicitly tell Mocha to use the TDD interface instead of the default BDD by specifying mocha -u tdd <testfile>
  - describe analogous to suite
  - it analogous to test
  - before analogous to setup
  - after analogous to teardown
  - beforeEach analogus to suiteSetup
  - afterEach analogus to suiteTeardown
- The mocha package can be installed via
  - npm install mocha --save-dev

Steps to debug

- Install node-inspector as a global module
  - npm install –g node-inspector
- There are two steps needed to get you up and debugging
- Step – 1: Start the Node Inspector Server
  - node-inspector
- Step – 2: Enable debug mode in your Node process
  - To start Node with a debug flag node --debug program.js
  - To pause script on the first line node –debug-brk program.js

IACSD

1. What is the difference between Node.js and JavaScript? Factor Node.js JavaScript
Engine V8 – Google Chrome V8, Spider Monkey, and JS Core
Usage To perform non-blocking activities For general client-side operations Working
Interpreter – Scripting Programming Language

2. What is Node.js?
Node.js is a very popular scripting language that is primarily used for server-side scripting requirements. It has numerous benefits compared to other server-side programming languages out there, the most noteworthy one being the non-blocking I/O.

3. Briefly explain the working of Node.js.
Node.js is an entity that runs in a virtual environment, using JavaScript as the primary scripting language. It uses a simple V8 environment to run on, which helps in the provision of features like the non-blocking I/O and a single-threaded event loop.

4. Where is Node.js used?
Node.js is used in a variety of domains. But, it is very well regarded in the design of the following concepts:

Network application Distributed computing Responsive web apps Server–Client applications

5. What is the difference between Node.js and Angular? Node.js Angular
Used in situations where scalability is a requirement Best fit for the development of real-time applications
Ability to generate queries in a database Ability to simplify an application into the MVC architecture
Mainly used to develop small/medium-sized applications Mainly used to develop real-time interactive web applications
Provides many frameworks such as Sails, Partial, and Express Angular is an all-in-one web app framework

6. Why is Node.js single-threaded?
Node.js works on the single-threaded model to ensure that there is support for asynchronous processing. With this, it makes it scalable and efficient for applications to provide high performance and efficiency under high amounts of load.

7. What are the different API functions supported by Node.js? There are two types of API functions. They are as follows:

Synchronous APIs: Used for non-blocking functions Asynchronous APIs: Used for blocking functions

8. What is the difference between synchronous and asynchronous functions?
Synchronous functions are mainly used for I/O operations. They are instantaneous in providing a response to the data movement in the server and keep up with the data as per the requirement. If there are no responses, then the API will throw an error.
On the other hand, asynchronous functions, as the name suggests, work on the basis of not being synchronous. Here, HTTP requests when pushed will not wait for a response to begin. Responses to any previous requests will be continuous even if the server has already got the response.

9. What is the control flow function?
The control flow function is a common code snippet, which executes whenever there are any asynchronous function calls made, and they are used to evaluate the order in which these functions are executed in Node.js.

10. Why is Node.js so popular these days?
Node.js has gained an immense amount of traction as it mainly uses JavaScript. It provides programmers with the following options:
Writing JavaScript on the server Access to the HTTP stack
File I/O entities
TCP and other protocols Direct database access
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11. What is an event loop in Node.js?
When running an application, callbacks are entities that have to be handled. In the case of Node.js, event loops are used for this purpose. Since Node.js supports the non-blocking send, this is a very important feature to have.
The working of an event loop begins with the occurrence of a callback wherever an event begins. This is usually run by a specific listener. Node.js will keep executing the code after the functions have been called, without expecting the output prior to the beginning.
Once, all of the code is executed, outputs are obtained and the callback function is executed. This works in the form of a continuous loop, hence the name event loop.

12. What are the asynchronous tasks that should occur in an event loop?
Following are some of the tasks that can be done using an event loop asynchronously: Blocking send requests
High computational requirement Real-time I/O operations

13. What is the order of execution in control flow statements?
The following is the order in which control flow statements are used to process function calls:
Handling execution and queue
Data collection and storage Concurrency handling and limiting Execution of the next piece of code

14. What are the input arguments for an asynchronous queue?
There are two main arguments that an asynchronous queue uses. They are: Concurrency value
Task function Career Transition

15. Are there any disadvantages to using Node.js?

A multi-threaded platform can run more effectively and provide better responsiveness when it comes to the execution of intensive CPU computation, and the usage of relational databases with Node.js is becoming obsolete already.
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16. What is the primary reason to use the event-based model in Node.js?
The event-based model in Node.js is used to overcome the problems that occur when using blocking operations in the I/O channel.
Next in this blog comprising Node.js questions, you need to understand how you can import libraries into Node.js.

17. How can you import external libraries into Node.js?
External libraries can be easily imported into Node.js using the following command: var http=require ("http")
This command will ensure that the HTTP library is loaded completely, along with the exported object.

18. What is meant by event-driven programming in Node.js?
Event-driven programming is a technique in which the workflow execution of a program is mainly controlled by the occurrence of events from external programs or other sources.
The event-driven architecture consists of two entities, namely: Event handling
Event selection

19. What is the difference between Ajax and Node.js? Ajax Node.js
Client-side programming technology Server-side scripting language Executes in the browser Executes on the server

20. What is the framework that is used majorly in Node.js today? Node.js has multiple frameworks, namely:

Hapi.js Express.js Sails.js Meteor.js Derby.js Adonis.js
Among these, the most used framework is Express.js for its ability to provide good scalability, flexibility, and minimalism.

21. What are the security implementations that are present in Node.js? Following are the important implementations for security:
Error handling protocols Authentication pipelines

22. What is the meaning of a test pyramid?
A test pyramid is a methodology that is used to denote the number of test cases executed in unit testing, integration testing, and combined testing (in that order). This is maintained to ensure that an ample number of test cases are executed for the end-to-end development of a project.

23. What is Libuv?

Libuv is a widely used library present in Node.js. It is used to complement the asynchronous I/O functionality of Node.js. It was developed in-house and used alongside systems such as Luvit, Julia, and more.

Following are some of the features of Libuv:

File system event handling Child forking and handling
Asynchronous UDP and TCP sockets Asynchronous file handling and operations
Next in these Node JS questions, you need to understand the functioning of Google Chrome.

To learn full-stack development in detail, sign up for this industry-based Full Stack Web Development Course.

24. Why does Google use the V8 engine for Node.js?
Google makes use of the V8 engine because it can easily convert JavaScript into a low-level language. This is done to provide high performance during the execution of an application and also to provide users with real-time abilities to work with the application.

25. What is the difference between spawn and fork methods in Node.js?
The spawn() function is used to create a new process and launch it using the command line. What it does is that it creates a node module on the processor. Node.js invokes this method when the child processes return data.

The following is the syntax for the spawn() method: child_process.spawn(command[, args][, options])

Coming to the fork() method, it can be considered as an instance of the already existing spawn() method. Spawning ensures that there is more than one active worker node to handle tasks at any given point in time.
The following is the syntax for the fork() method: child_process.fork(modulePath[, args][, options])
If you are looking forward to becoming proficient in Angular.js, then make sure to check out Intellipaat's latest offerings for the Angular JS Course.

26. What is the use of middleware in Node.js?
A middleware is a simple function that has the ability to handle incoming requests and outbound response objects. Middleware is used primarily for the following tasks:
Execution of code (of any type) Updating request and response objects
Completion of request–response iterations Calling the next middleware

27. What are global objects in Node.js?
Global objects are objects with a scope that is accessible across all of the modules of the Node.js application. There will not be any need to include the objects in every module. One of the objects is declared as global. So, this is done to provide any functions, strings, or objects access across the application.

28. Why is assert used in Node.js?
Assert is used to explicitly write test cases to verify the working of a piece of code. The following code snippet denotes the usage of assert:

```
var assert = require('assert'); function add(x, y) {
return x + y;
}
var result = add(3,5);
assert( result === 8, 'three summed with five is eight');
```

29. What are stubs in Node.js?
Stubs are simply functions that are used to assess and analyze individual component behavior. When running test cases, stubs are useful in providing the details of the functions executed.

30. How is a test pyramid implemented using the HTML API in Node.js?
Test pyramids are implemented by defining the HTML API. This is done using the following: A higher number of unit test cases
A smaller number of integration test methods A fewer number of HTTP endpoint test cases

31. Why is a buffer class used in Node.js?

A buffer class is primarily used as a way to store data in Node.js. This can be considered as a similar implementation of arrays or lists. Here, the class refers to a raw memory location that is not present in the V8 heap structure.

The buffer class is global, thereby extending its usage across all the modules of an application.

32. Why is ExpressJS used?
Node JS Express is a widely used framework built using Node.js. Express.js uses a management point that controls the flow of data between servers and server-side applications.

Being lightweight and flexible, Express.js provides users with lots of features used to design mobile applications.

33. What is the use of the connect module in Node.js?
The connect module in Node.js is used to provide communication between Node.js and the HTTP module. This also provides easy integration with Express.js, using the middleware modules.

34. What are streams in Node.js?
Streams are a set of data entities in Node.js. These can be considered similar to the working of strings and array objects. Streams are used for continuous read/write operations across a channel. But, if the channel is not available, then all of the data cannot be pushed to the memory at once. Hence, using streams will make it easy to process a large set of data in a continuous manner.

Advanced Node.js Interview Questions for Experienced Professionals

35. What are the types of streams available in Node.js? Node.js supports a variety of streams, namely:

Duplex (both read and write) Readable streams
Writable streams
Transform (duplex for modifying data)

36. What is the use of REPL in Node.js?
REPL stands for Read-Eval-Print-Loop. It provides users with a virtual environment to test JavaScript code in Node.js.

To launch REPL, a simple command called 'node' is used. After this, JavaScript commands can be typed directly into the command line.

37. What is meant by tracing in Node.js?
Tracing is a methodology used to collect all of the tracing information that gets generated by V8, the node core, and the userspace code. All of these are dumped into a log file and are very useful to validate and check the integrity of the information being passed.

38. Where is package.json used in Node.js?
The 'package.json' file is a file that contains the metadata about all items in a project. It can also be used as a project identifier and deployed as a means to handle all of the project dependencies.

39. What is the difference between readFile and createReadStream in Node.js?
readFile: This is used to read all of the contents of a given file in an asynchronous manner. All of the content will be read into the memory before users can access it.
create ReadStream: This is used to break up the field into smaller chunks and then read it. The default chunk size is 64 KB, and this can be changed as per requirement.

40. What is the use of the crypto module in Node.js?
The crypto module in Node.js is used to provide users with cryptographic functionalities. This provides them with a large number of wrappers to perform various operations such as cipher, decipher, signing, and hashing operations.

41. What is a passport in Node.js?
Passport is a widely used middleware present in Node.js. It is primarily used for authentication, and it can easily fit into any Express.js-based web application.

With every application created, it will require unique authentication mechanisms. This is provided as single modules by using passport, and it becomes easy to assign strategies to applications based on requirements, thereby avoiding any sort of dependencies.

42. How to get information about a file in Node.js?

The fs.stat function is used to get the required information from a file. The syntax is as follows: fs.stat(path, callback) where,

Path: The string that has the path to the name
Callback: The callback function where stats is an object of fs.stats

43. How does the DNS lookup function work in Node.js?
The DNS lookup method uses a web address for its parameter and returns the IPv4 or IPv6 record, correspondingly.

There are other parameters such as the options that are used to set the input as an integer or an object. If nothing is provided here, both IPv4 and IPv6 are considered. The third parameter is for the callback function.

The syntax is:

dns.lookup(address, options, callback)

44. What is the use of EventEmitter in Node.js?
Every single object in Node.js that emits is nothing but an instance of the EventEmitter class. These objects have a function that is used to allow the attachment between the objects and the named events.

Synchronous attachments of the functions are done when the EventEmitter object emits an event.

45. What is the difference between setImmediate() and setTimeout()?
The setImmediate() function is meant to execute a single script once the current event loop is complete.

The setTimeout() function is used to hold a script and schedule it to be run after a certain time threshold is over.

The order of execution will solely depend on the context in which the functions are called. If called from the main module, the timing will be based on the performance of the process.

46. What is the use of module.exports in Node.js?
The module.exports function is used to expose two functions and bring them to a usable context. A module is an entity that is used to store relative code in a single snippet. This can be considered as an operation of moving all of the functions into one single file.

JQuery

- jQuery is a JavaScript library (single file)
- It supports cross browser
- Select HTML elements
- Handle Events
- Animate HTML elements
- Make Ajax calls
- 1000's of plug-ins available

Why Jquery

- JavaScript is great for a lot of things especially manipulating the DOM but it's pretty complex stuff. DOM manipulation is by no means straightforward at the base level, and that's where jQuery comes in. It abstracts away a lot of the complexity involved in dealing with the DOM, and makes creating effects super easy.
- It can locate elements with a specific class
- It can apply styles to multiple elements
- It solves the cross browser issues
- It supports method chaining
- It makes the client side development very easy

- VS 2008 / 2010 provides jQuery Intellisense
- http://www.appendto.com/community/jquery-vsdoc
- Place jQuery-vsdoc.js file into the same path as the jquery.js file
- http://weblogs.asp.net/scottgu/archive/2008/11/21/jquery-intellisense-in-vs- 2008.aspx
- Other IDE's
- Eclipse(with plug-in) - http://www.eclipse.org/
- Aptana Studio - http://www.aptana.com/

- Script can be also accessible from
- Microsoft - http://ajax.aspnetcdn.com/ajax/jQuery/jquery-1.6.2.min.js
- jQuery - http://code.jquery.com/jquery-1.6.2.min.js
- Google - http://ajax.googleapis.com/ajax/libs/jquery/1.6.2/jquery.min.js

Content Delivery Network(CDN)

- A CDN short for Content Delivery Network distributes static content across servers in various, diverse physical locations. When a user's browser resolves the URL for these files, their download will automatically target the closest available server in the network.

- If jQuery is hosted locally then users must download it at least once. Each of your users probably already has dozens of identical copies of jQuery in their browser's cache, but those

copies of jQuery are ignored when they visit your site. Even if someone visits hundreds of sites using the same CDN hosted version of jQuery, they will only need download it once!
noConflict method

- Many JavaScript libraries use $ as a function or variable name, just as jQuery does.
- In jQuery's case, $ is just an alias for jQuery, so all functionality is available without using $. If we need to use another JavaScript library alongside jQuery, we can return control of $ back to the other library with a call to $.noConflict

```
<script type="text/javascript" src="other_lib.js"></script>
<script type="text/javascript" src="jquery.js"></script>
<script type="text/javascript">
$.noConflict();
//Code that uses other libraries $ can follow here.
</script>
```

jQuery Selectors

- jQuery uses same CSS selectors used to style our page to manipulate elements on the page.
- CSS selectors select elements to add style to those elements where as jQuery selectors select elements to add behavior to those elements.
- Selectors allow page elements to be selected.
- Single or Multiple elements are supported.
- A Selector identifies an HTML element / tag that will be manipulated with jQuery Code.
- Selector Syntax
  - $(selectorExpression)
  - jQuery(selectorExpression)

Selecting by Tag Name

- Selecting single tag takes the following syntax
  - $('div') – selects all elements
  - $('a') – selects all <a> elements
- To reference multiple tags, use the (,) to separate the elements
  - $('p, div, span') - selects all paragraphs, divs and span elements

Selecting Descendants

- $('ancestor descendant') - selects all the descendants of the ansector
  - $('table tr') - Selects all tr elements that are the descendants of the table element
- Descendants can be children, grand children etc of the designated ancestor element.

Selecting by Element ID

- It is used to locate the DOM element very fast.
- Use the # character to select elements by ID
  - $('#myID') – selects element

Selecting Elements by Class Name

- Use the (.) character to select elements by class name
  - $('.myclass') - selects element
- To reference multiple tags, use the (,) character to separate the class name.
  - $('.blueDiv,.redDiv') - selects all the elements containing the class blueDiv and redDiv
- Tag names can be combined with elements name as well.
  - $('div.myclass') – selects only tags with class="myclass"

Selecting by attribute values

- Use brackets [attribute] to select based on attribute name and/or attribute value
  - $('a[title]') - selects all anchor elements that have a title attribute
  - $('a[title="trainer"]') – selects all <a> elements that have a "trainer" title attribute value

Selecting by input elements

- To select all input elements
  - $(':input') - selects input, select, textarea, button,image, radio etc
  - $(':input[type="radio"]') – selects all radio buttons

Additional Selectors

- :contains() will select elements that match the contents.
  - $('div:contains("KLFS")') - selects div's which contains the text KLFS(match is case sensitive)
- $('element:odd') and $('element:even') is the jQuery syntax for selecting odd and even positions respectively.
  - Index is 0 based. Odd returns(1,3,5…) and Even returns (0,2,4…)
- $('element:first-child') and $('element:last-child') is the jQuery syntax for selecting the first child and last child of every element group.
  - $('span:first-child') returns the span which is a first child for all the groups

Additional Selectors (Contd)

- $('attribute^="value") and $('attribute$="value') is the jQuery syntax for selecting all the elements with an attribute that begins and end with stated value.
- $('input[value^="Company"]') – selects any input element whose value starts with Company ('^' can be replaced with '*' to retrieve the elements contains the value company

JSON Introduction

- Java Script Object Notation
- JSON is a lightweight format for exchanging data between the client and server.
- JSON is a syntax for passing around objects that contain name/value pairs, arrays and other objects.
- It is often used in AJAX applications because of its simplicity and because its format is based on JavaScript object literals.
- JSON is language independent and text based. It is easy to parse and generate.
- Supported by most of the languages.

JSON Types

- Number : integer, real or floating point
- String : double-quoted Unicode with backslashes
- Boolean : true and false
- Array : ordered sequence of comma-separated values enclosed in square brackets
- Object : collection of comma-separated "key":value pairs enclosed in Curly braces
- null

Using JSON in jQuery

- A JSON object can be passed as input into jQuery Methods, so that we can avoid method chaining.
- We can parse a JSON string in jQuery using the following syntax var obj = jQuery.parseJSON(jsonString);

Interacting with DOM

Iterating through Nodes

.each(function(index,Element))is used to iterate through jQuery objects

```
$('div').each (function (index){alert(index+ '= '+$(this).text());
});
```

Iterates through each div element and returns its index number and text

```
$('div').each (function
(index,element){
alert(index+ '= '+$(element).text());
});
```

Modifying Object Propertie

- The this.ProperyName statement can be used to modify an object's properties directly.

```
$('div').each (function (index){
this.title = "Index = "+index;
});
```

- Iterates through each div and modifies the title. If the property does not exit, it will be added

Working with Attributes

- Object attributes can be used using attr():
  - var val = $('#customDiv').attr('title'); - Retrieves the title attribute value
- .attr(attributeName,value) is the method used to access an object's attributes and modify the values.
  - $('img').attr('title','Image title'); - changes the title attribute value to Image title.
- To modify multiple attributes, pass JSON object.

```
$('img').attr({
"title":  "image title",
"style" : "border:2px solid black"
});
```

Adding and Removing Nodes

- In traditional approach adding and removing nodes is tedious.
- To insert nodes four methods were available
- Appending adds children at the end of the matching elements
  - .append()
  - .appendTo()
- Prepending adds children at the beginning of the matching elements
  - .prepend()
  - .prependTo()
- To wrap the elements use .wrap()
- To remove nodes from an element use .remove()

Modifying Styles

- .css() function is used to modify an object's style
  - $('div').css('color','red');
- Multiple styles can be modified by passing a JSON Object

```
$('div').css({
        "color":"red",
        "font-weight":"bold" });
```

Working with Classes

- The four methods for working with css class attributes are
  - .addClass()
  - .hasClass()
  - .removeClass()
  - .toggleClass()

- .addClass() adds one or more class names to the class attribute of each element.
  - $('p').addClass('classOne');
  - $('p').addClass('classOne classTwo');

- .hasClass() returns true if the selected element has a matching class that is specified
  - if($('p').hasClass('classOne')) { //perform operation}

- .removeClass() can remove one or more classes
  - $('p').removeClass('classOne classTwo');

- To remove all class attributes for the matching selector
  - $('p').removeClass();

- .toggleClass() alternates adding or removing a class based on the current presence or absence of the class.
  - $('#targetDiv').toggleClass('highlight');

Handling Events & Animations

Event attachment technique
myButton.addEventListener('click',function( ) { },false);

jQuery Event Model Benefits

- Events notify a program that a user performed some type of action
- jQuery provides a cross-browser event model that works common across all browsers.
- jQuery event model is simple to use and provides a compact syntax

jQuery Events

- click()
- blur()
- focus()
- dblclick()
- mousedown()
- mouseup()
- mouseover()
- keydown()
- keypress()

Handling Click Events

- .click(handler(eventObject)) is used to listen for a click event or trigger a click event on an element
  - $('#submitButton').click(function() { alert('Clicked') });

- Raising a click event from with in another function
  - $('#otherID').click(function() { $('#myID').click( ); }); - this would fire when the element otherID was clicked and raise the click event for myID

bind() and unbind() Method

- bind() method is used to bind events dynamically
- .bind(eventType,handler(eventObject)) attaches a handler to an event for the selected element(s).
  - $('#submitButton').bind('click', function() { //handle event });
  - .click() is the same as .bind('click')

- .unbind(event) is used to remove handler previously bound to an element.
  - $('#submitButton').unbind();
  - $('#submitButton').unbind('click'); - unbind specific event
- bind() allows multiple events to be bound to one or more elements
  - $('#targetDiv').bind('mouseenter mouseleave', function() { //handle event });

live() and delegate() functions

- live() and delegate() allow new elements added into the DOM to automatically be attached to an event.
- live() method allows binding of event handlers to elements that match a selector, including future elements. Events bubble up to the document object
- delegate() method is a replacement for live() in jQuery 1.4. It attaches an event handler directly to the selector context

- Event handlers can be set using live()
- The document object handles the event by default
- It works even when new objects were added in to the DOM
  - $('.someclass').live('click',somefunction) – Any element added with .someclass will have the click event
- Stop live event handling using die()
  - $('.someclass').die('click',somefunction)

Using delegate() and undelegate()

- Newer version of live() added in jQuery 1.4
- The context object handles the event by default rather than the document object.
- Works even when new objects are added into the DOM.
  - $('#targetDiv').delegate('div','click',somefunction);

- Stop delegate event handling using undelegate()

Hover Events

- Hover events can be handled using hover()
  - $(selector).hover(handlerIn,handlerOut)
  - handlerIn is equivalent to mouseenter and handlerOut is equivalent to mouseleave
- Another option is $(selector).hover(handlerInOut)
- Fires the same handler for mousenter and mouseleave events

Showing and Hiding Elements

- To set a duration and a callback function
  - show(duration, callback)
  - duration is the amount of time taken (in milliseconds), and callback is a callback function jQuery will call when the transition is complete.
- The corresponding version of hide( )
  - hide(duration, callback)
- To toggle an element from visible to invisible or the other way around with a specific speed and a callback function, use this form of toggle( )
  - toggle(duration, callback)

jQuery Sliding Effects

- The jQuery slide methods gradually change the height for selected elements.
- jQuery has the following slide methods:
  - $(selector).slideDown(speed,callback)
  - $(selector).slideUp(speed,callback)
  - $(selector).slideToggle(speed,callback)
- The speed parameter can take the following values: "slow", "fast", "normal", or milliseconds.
- The callback parameter is the name of a function to be executed after the function completes.

jQuery Fading Effects

- The jQuery fade methods gradually change the opacity for selected elements.
- jQuery has the following fade methods:
  - $(selector).fadeIn(speed,callback)
  - $(selector).fadeOut(speed,callback)
  - $(selector).fadeTo(speed,opacity,callback)
- The speed parameter can take the following values: "slow", "fast", "normal", or milliseconds.
- The opacity parameter in the fadeTo() method allows fading to a given opacity.
- The callback parameter is the name of a function to be executed after the function completes.

Creating Custom Animation

- Custom animation can be created in jQuery with the animate() function
  - animate(params, duration, callback)
  - params contains the properties of the object you're animating, such as CSS properties, duration is the optional time in milliseconds that the animation should take and callback is an optional callback function.

jQuery Ajax features

- Allows part of a page updated
- Cross-Browser support
- Simple API
- GET and POST supported
- Load JSON,XML, HTML …

jQuery Ajax functions

- jQuery provides several functions that can be used to send and receive data
  - $(selector).load() : Loads HTML data from the server
  - $.get() and $.post() : Get raw data from the server
  - $.getJSON() : Get / Post and return JSON data
  - $.ajax() : Provides core functionality
- jQuery Ajax functions works with REST APIs, Webservices and more

Loading HTML content from server

- $(selector).load(url,data,callback) allows HTML content to be loaded from a server and added into DOM object.
  - $("#targetDiv").load('GetContents.html');
- A selector can be added after the URL to filter the content that is returned from the calling load().
  - $("#targetDiv").load('GetContents.html #Main');
- Data can be passed to the server using load(url,data)
  - $('#targetDiv').load('Add.aspx',{firstNumber:5,secondNumber:10})
- load () can be passed a callback function

$('#targetDiv').load('Notfound.html', function (res,status,xhr) {If (status == "errror") { alert(xhr.statusText); } });

Using get(), getJSON() & post()

- $.get(url,data,callback,datatype) can retrieve data from a server.

```
$.get('GetContents.html',function(data){
$('#targetDiv').html(data);
},'html');
```

- datatype can be html, xml, json
- $.getJSON(url,data,callback) can retrieve data from a server.

```
$.getJSON('GetContents.aspx,{id:5},function(data){
$('#targetDiv').html(data);
});
```

- **$.post(url,data,callback,datatype) can post data to a server and retrieve results.**

Using ajax() function

- **ajax() function is configured by assigning values to JSON properties**

```
$.ajax({
url: "employee.asmx/GetEmployees",
data : null,
contentType: "application/json; charset=utf-8",
datatype: 'json',
success: function(data,status,xhr){
//Perform success operation
},
error: function(xhr,status,error) {
//show error details
}
});
```

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