



NodeJS



Training Agenda

JavaScript Overview

NodeJS Overview

Modules System

File System

Buffers & Streams

Event System

Express

Data Persistence

View Engines

Socket Programming

NodeJS Securities

Prerequisites:



Basic knowledge of HTML, CSS
& JavaScript



Interest to Learn

JavaScript Overview



LIGHT-
WEIGHT



SCRIPTING
LANGUAGE



INTERPRETER
BASED



EVENT
DRIVEN



SINGLE
THREADED

JavaScript Building Blocks

Functions

- Function Expressions
- HOF
- Nested Functions
- IIFE

Objects Creation Methods

- Literal
- Constructor
- Instance


Prototyping

- Object Blueprint



NodeJS

“Node.js is a platform built on Chrome's JavaScript runtime for easily building fast and scalable network applications. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient, perfect for data-intensive real-time applications that run across distributed devices.”



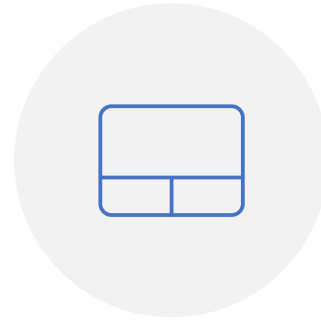
NodeJS : Features

- Extremely fast
- I/O is Asynchronous
- Event Driven
- Single threaded
- Highly Scalable
- Open source

NodeJS Process Model



Node.js runs in a single process and the application code runs in a single thread.



All the user requests to web application will be handled by a single thread and all the I/O work or long running job is performed asynchronously for a request.

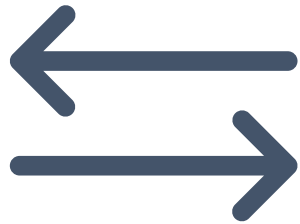


An event loop is constantly watching for the events to be raised for an asynchronous job and executing callback function when the job completes.



Internally, Node.js uses libuv for the event loop which in turn uses internal C++ thread pool to provide asynchronous I/O.

NodeJS : Module System



Use of imports/exports for importing and exporting the modules in application.



Following are a few salient points of the module system:

Each file is its own module.

Each file has access to the current module definition using the module variable.

The export of the current module is determined by the module.exports variable.

To import a module, use the globally available require function.



NodeJS : Module System

- If something is a core module, return it.
- If something is a relative path (starts with './' , '../') return that file OR folder.
- If not, look for node_modules/filename or node_modules/foldername each level up until you find a file OR folder that matches something.
- If it matched a file name, return it. If it matched a folder name and it has package.json with main, return that file.
- If it matched a folder name and it has an index file, return it.



NodeJS : Require Function



The Node.js require function is the main way of importing a module.



The require function blocks further code execution until the module has been loaded.



Call require() based on some condition and therefore load the module on-demand



After the first time a require call is made to a particular file, the module.exports is cached.



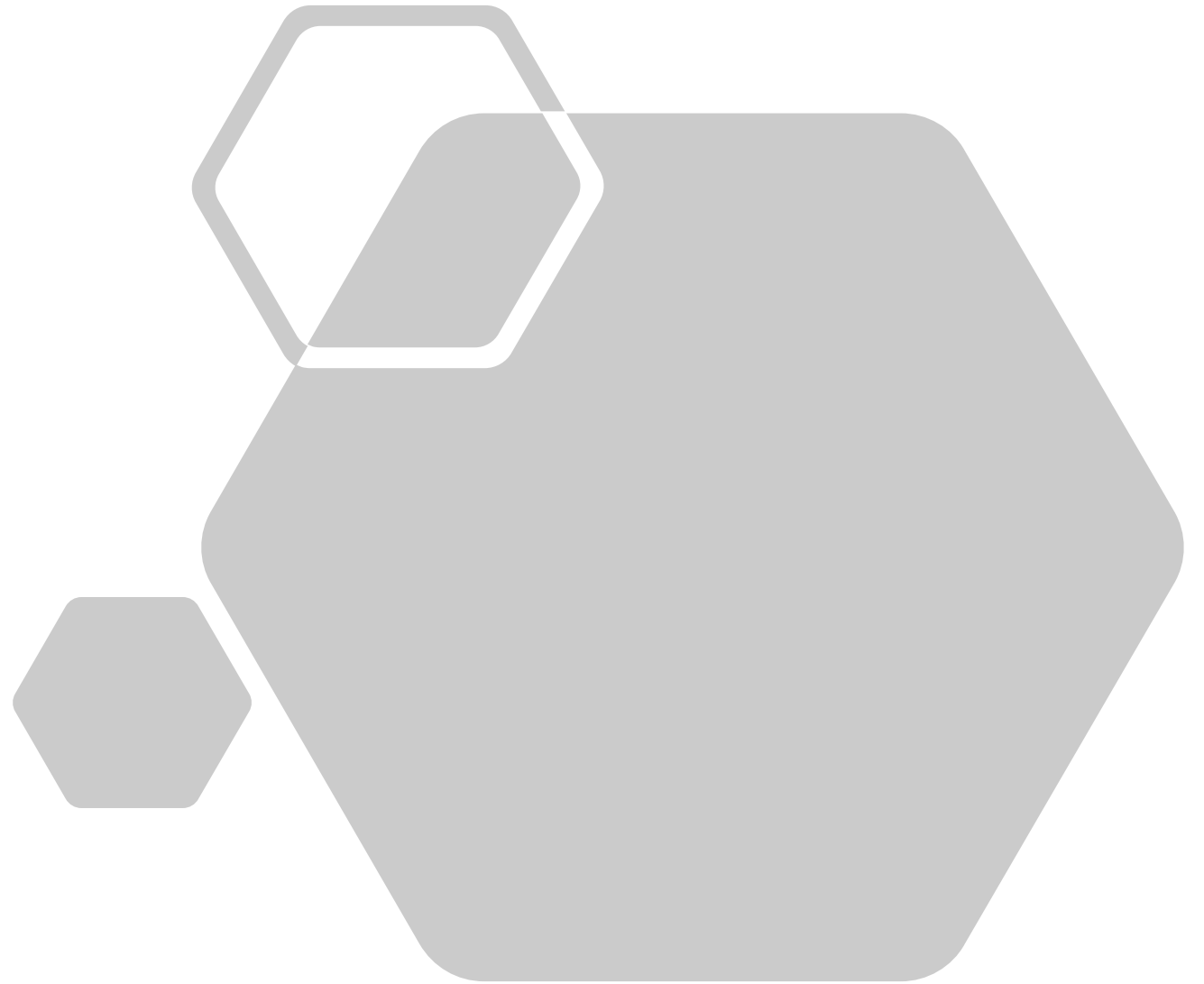
Module allows you to share in-memory objects between modules.



Treats module as an object factory

NodeJS : Few Core Modules

- path
- os
- event
- utils
- http
- fs
- and many more



NodeJS: Working with File System



Node.js includes fs module to access physical file system.



The fs module is responsible for all the asynchronous or synchronous file I/O operations.

Task – Notes App

- **Notes App should provide following features -**
 - User should be able to run command from command prompt to create, read, delete and list the notes.
 - Should use local file storage
 - Should use terminal colors
- **Commands to run -**
 - > `node index.js add --title="New Title" --body="New Title Body"`
 - > `node index.js read --title="Some Title"`
 - > `node index.js remove --title="Some Title"`
 - > `node index.js list`



NodeJS : Built-in Global Variables



Console

The console plays an important part in quickly showing what is happening in your application when you need to debug it.



Timers

setTimeout only executes the callback function once after the specified duration. But setInterval calls the callback repeatedly after every passing of the specified duration.



__filename and __dirname

These variables are available in each file and give you the full path to the file and directory for the current module.



Process

Use the process object to access the command line arguments. Used to put the callback into the next cycle of the Node.js event loop.



Buffer

Native and fast support to handle binary data

Node Package Manager

NPM is the eco-system to manage the project dependencies

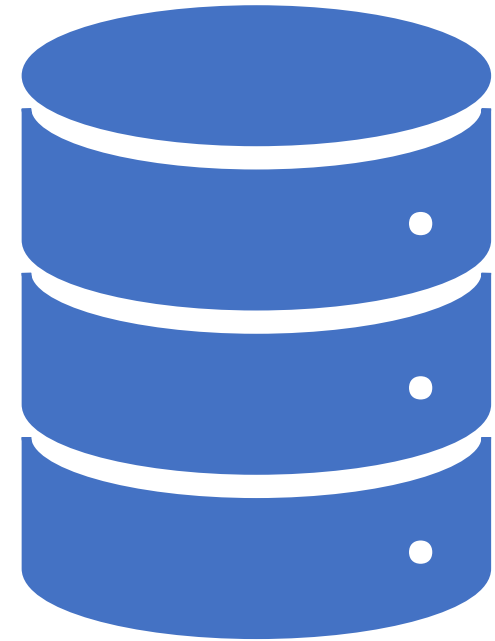
Commands	Description
npm install	Install the packages/dependencies
npm uninstall	Uninstall the packages/dependencies
npm config get/set	Get /set the npm eco-system
npm update	Update the project dependencies
npm ls	List down the dependencies
npm search	Search the listed package on npm registry
npm init	Generates package.json file in local project directory
npm outdated	List down the outdated package

NodeJS : Event System

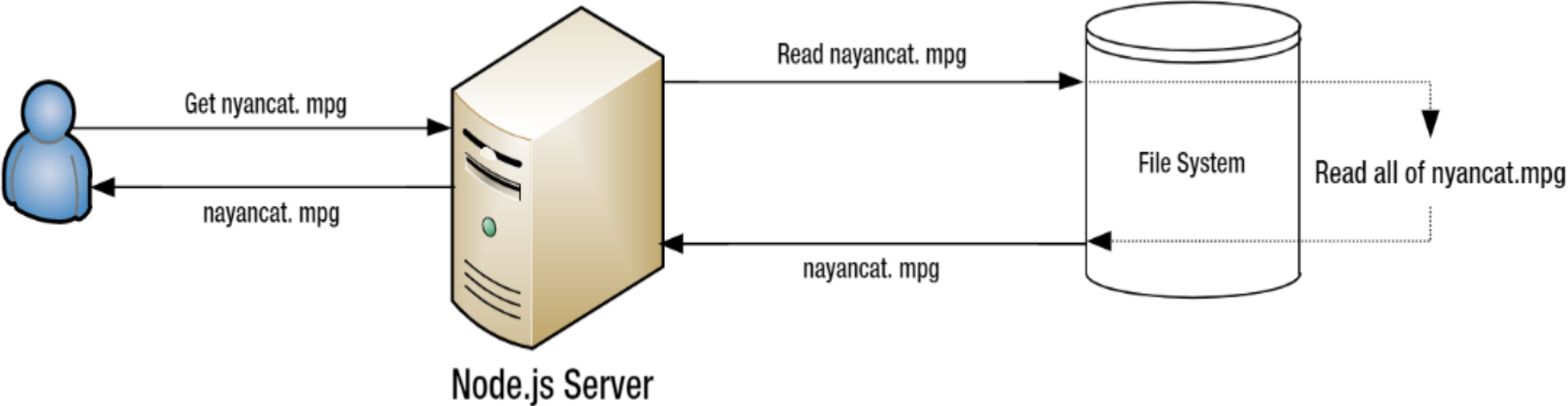
- EventEmitter is a class designed to make it easy to emit events and subscribe to raised events.
 - Subscribing :
 - built-in support for multiple subscribers is one of the advantages of using events.
 - Unsubscribing :
 - EventEmitter has a `removeListener` function that takes an event name followed by a function object to remove from the listening queue.
- EventEmitter provides a function `once` that calls the registered listener only once.
- EventEmitter has a member function, `listeners`, that takes an event name and returns all the listeners subscribed to that event.
- Memory Leak : A common cause of memory leak is forgetting to unsubscribe for the event.
- A number of classes inside core Node.js inherit from EventEmitter.

Buffers & Streams

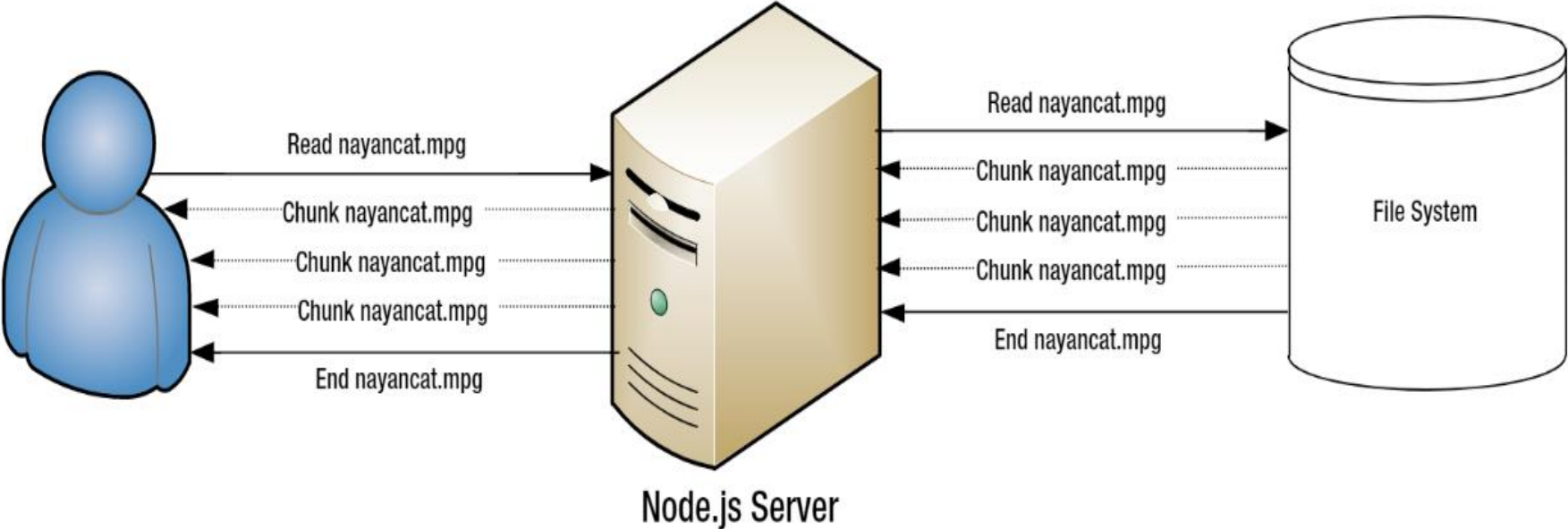
- Streams play an important role in creating performant web applications.
- Main motivation behind streams -
 - Improvement in user experience
 - better utilization of server resources
- All of the stream classes inherit from a base abstract Stream class which in turn inherits from EventEmitter.
- All the streams support a pipe operation that can be done using the pipe member function.

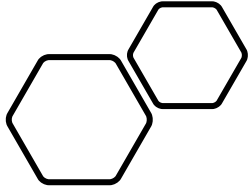


Buffered Web Response



Streaming Web Response





NodeJS : Streams (Cntd...)



Readable

A readable stream is one that you can read data from but not write to.

Process.stdin, which can be used to stream data from the standard input.



Writable

A writable stream is one that you can write to but not read from.

Process.stdout, which can be used to stream data to the standard output.



Transform

A transform stream is a special case of a duplex stream where the output of the stream is in some way computed from the input.

Encryption and compression streams.



Duplex

A duplex stream is one that you can both read from and write to.

Network socket. You can write data to the network socket as well as read data from it.

Express

Fast, unopinionated, minimalist web framework



WEB APPLICATION
FRAMEWORK FOR
NODE APPS.



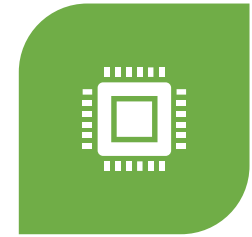
EXPRESS CAN ACCEPT
MIDDLEWARE USING
THE 'USE' FUNCTION
WHICH CAN BE
REGISTERED WITH
HTTP.CREATESERVER.



EXPRESS REQUEST /
RESPONSE OBJECTS
ARE DERIVED FROM
STANDARD NODEJS
HTTP REQUEST /
RESPONSE



REQUEST OBJECT
CAN HANDLE URL :
ROUTE PARAMETER
& QUERYSTRINGS



EXPRESS ROUTER IS
USED TO MOUNT
MIDDLEWARES AND
ACCESS ALL REST
APIS

Task – Weather App

- **Weather App should provide following features -**
 - User should be able to see the weather of the provided location.
 - Should use mapbox API
 - Should use Darksky API



Data Persistence



Why NoSQL ?

- Scalability
- Ease of Development



NoSQL servers can be placed into four broad categories:

- Document databases (e.g. MongoDB)
- Key-value databases (e.g. Redis)
- Column-family databases (e.g. Cassandra)
- Graph databases (e.g. Neo4J)

MongoDB

- A MongoDB deployment consists of multiple databases.
- Each database can contain multiple collections.
- A collection is simply a name that you give to a collection of documents.
 - Each collection can contain multiple documents.
 - A document is effectively a JSON document

> `npm install mongodb`



Mongoose

- Mongoose provides a straightforward, schema-based solution to model your application data.
- It includes built-in type casting, validation, query building, business logic hooks and more, out of the box.

> `npm install mongoose`



Task – REST API : Todo App

Todo App should provide following API



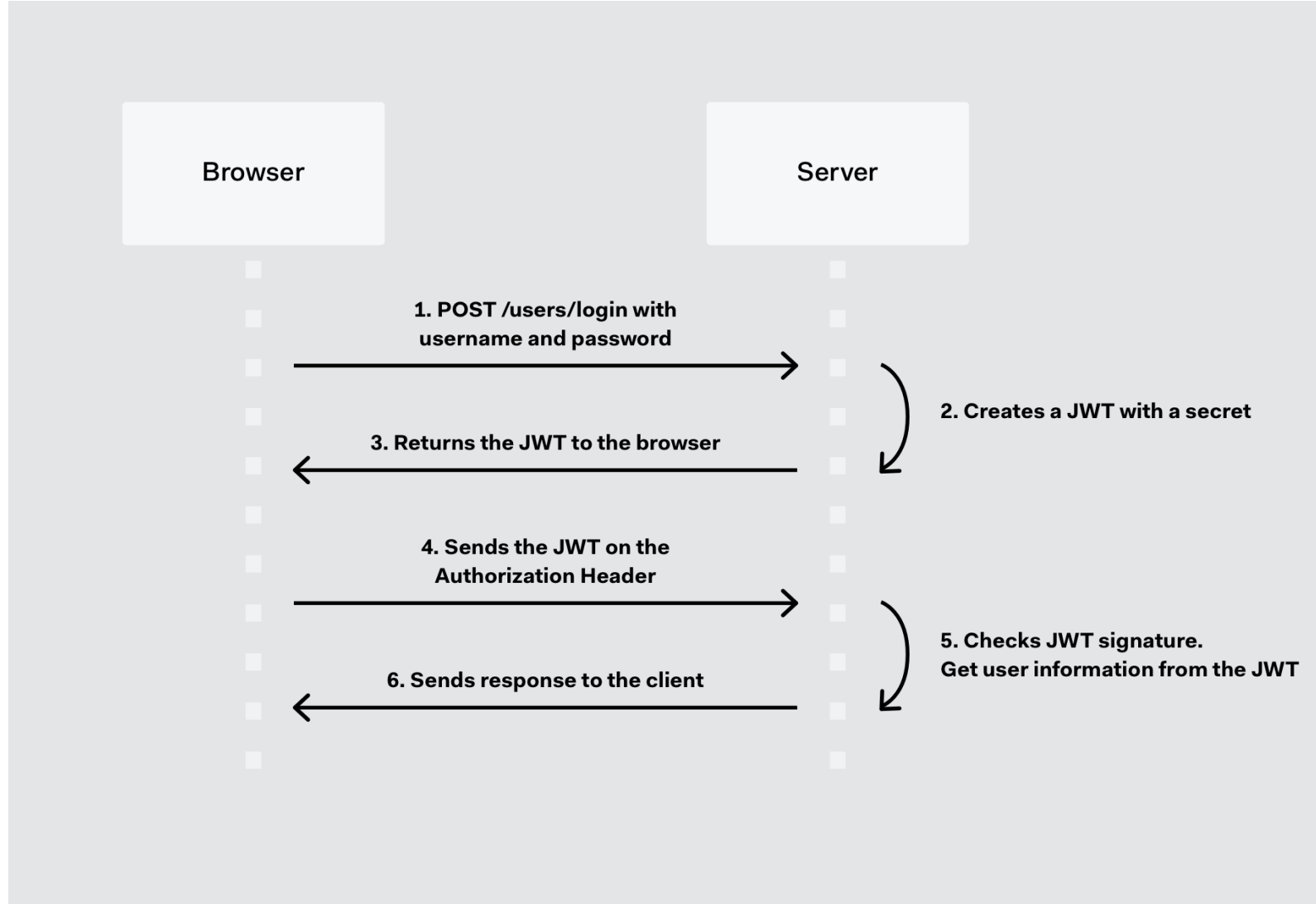
METHOD	API	DESCRIPTION
GET	/todos	Get all todo items
POST	/todos	Create todo item
GET	/todos/{id}	Get single todo item
PATCH	/todos/{id}	Update single todo item
DELETE	/todos/{id}	Delete single to item

NodeJS : Securities

A JSON Web Token (JWT), defines an explicit, compact, and selfcontaining secured protocol for transmitting restricted information.

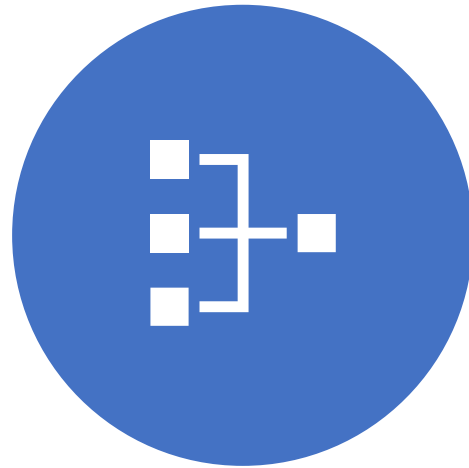
The JWT Claims Set represents a compact URL-safe JSON object, that is base64url encoded and digitally signed and/or encrypted.

The JSON object consists of zero or more name/ value pairs, where the names are strings and the values are arbitrary JSON values.

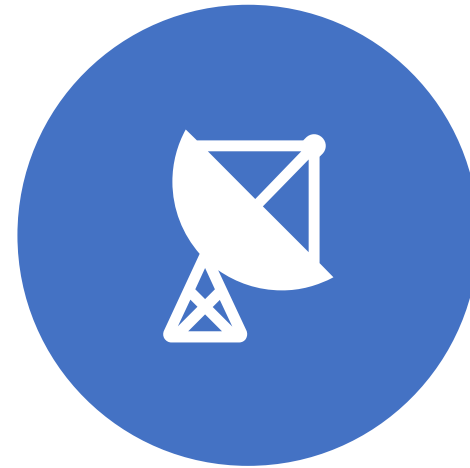


JWT : Understanding

Socket Programming



BI-DIRECTIONAL FULL
DUPLEX COMMUNICATION



CONTINUOUS CHANNEL OF
COMMUNICATION

View Engines



Jade

Uses whitespace and indentation as a part of the syntax.



Handlebar

Developers can't write a lot of JavaScript logic inside the templates.



EJS

Follows JavaScript-ish syntax. Embed JavaScript code in template. Commonly used.



Vash

Vash is a template view engine that uses Razor Syntax. Look familiar to people who have experience in ASP.Net MVC.

References



Books

NodeJS by Basarat Ali Syed

Node.JS Web Development by David Herron



Web

<https://nodejs.org>

<http://npmjs.com>

<https://github.com/mongodb/node-mongodb-native>

<https://mongoosejs.com/docs/api.html>

<http://expressjs.com/>

<https://stackoverflow.com>