NPM & Modules

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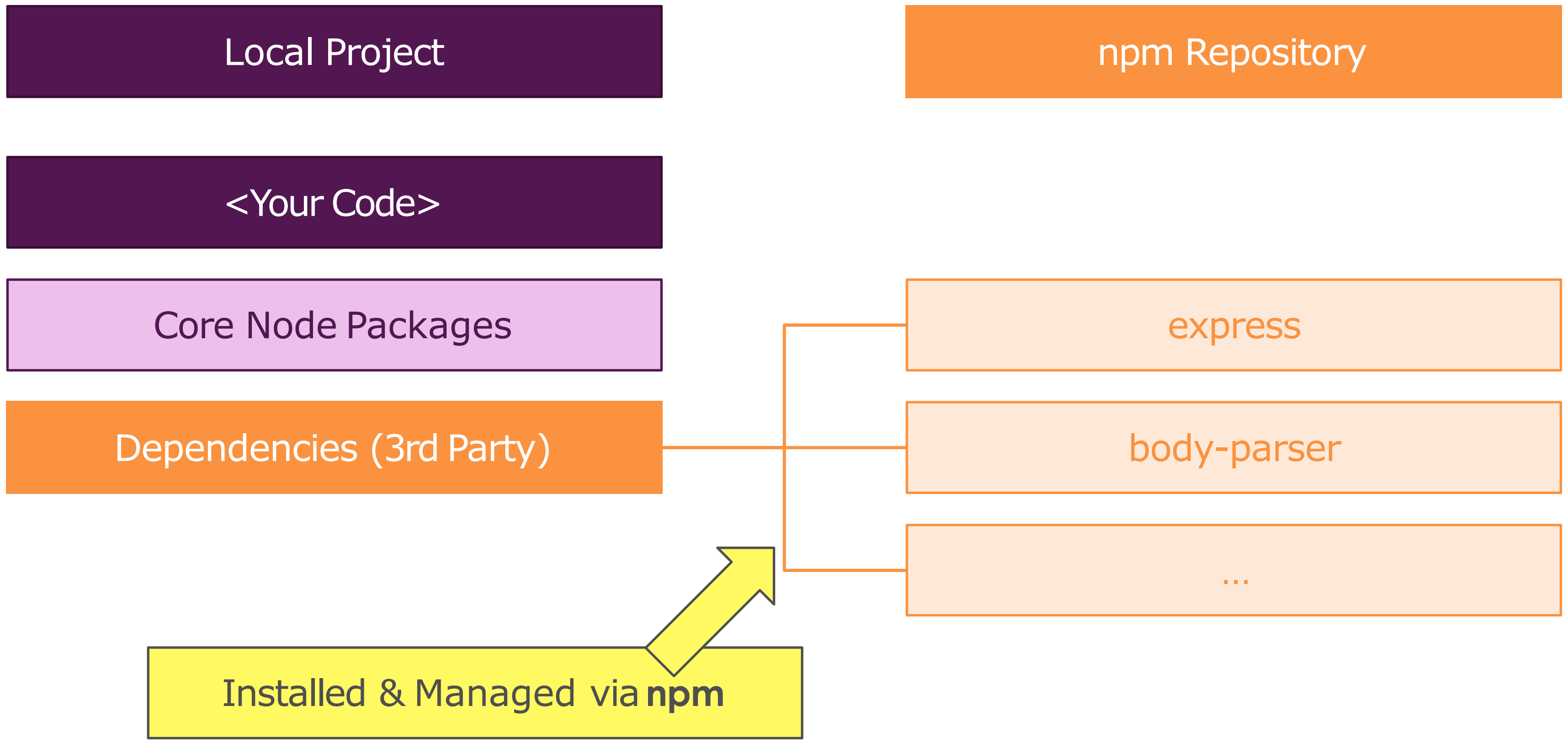
npm & packages Intro



What is npm?

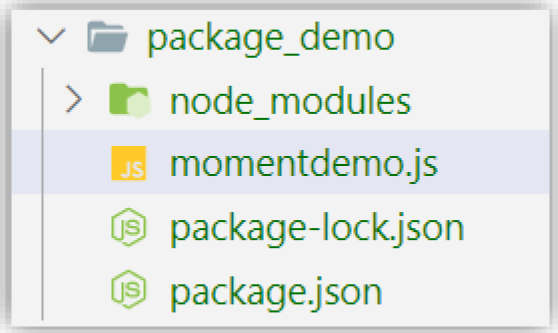
- **npm** is the standard package manager for Node.js. It also manages downloads of dependencies of your project.
- www.npmjs.com hosts thousands of free packages to download and use.
- The NPM program is installed on your computer when you install Node.js.
  - `npm -v // will print npm version`

- What is a package?
  - A package in Node.js contains all the files you need for a module.
  - Modules are JavaScript libraries you can include in your project.

  - A package contains:
    - JS files
    - `package.json` (manifest)
    - `package-lock.json` (maybe)

Create & use a new package

```
npm init // will create package.json
npm install moment --save
// moment is a package that parse, validate, manipulate and display dates
```



```
package_demo
  node_modules
  momentdemo.js
  package-lock.json
  package.json
```

- When we install a package:
  - Notice dependencies changes in `package.json`
  - notice folder: `node_modules`
  - This structure separate our app code to the dependencies. Later when we share/deploy our application, there's no need to copy `node_modules`, run: `npm install` will read all dependencies and install them locally.

momentdemo.js

```
var moment = require('moment');
console.log(moment().format("LLLL")); //Sunday, June 13,
2021 6:24 PM
```

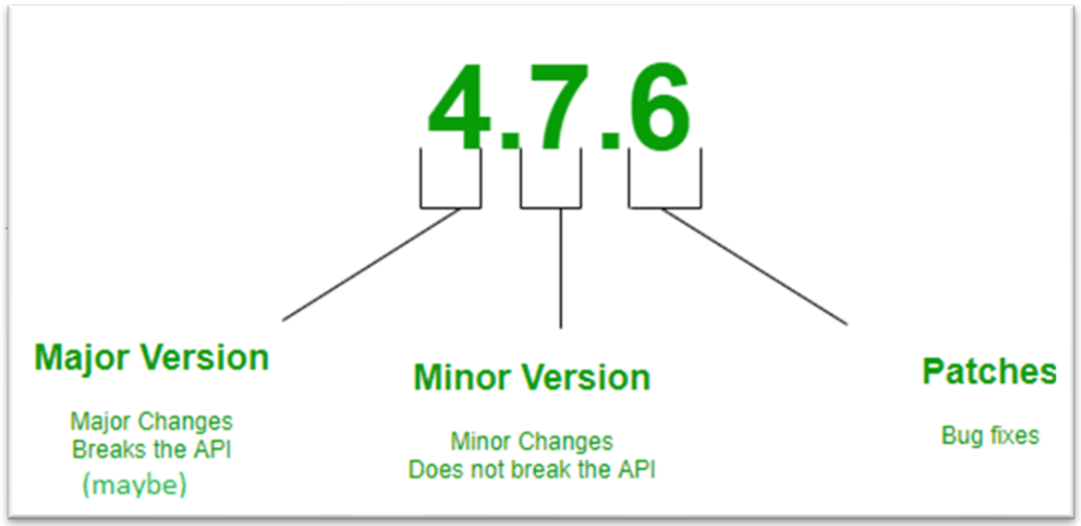
package.json Manifest

- The package.json file is kind of a manifest for your project.
- It can do a lot of things, completely unrelated.
- It's a central repository of configuration for installed packages.
- The only requirement is that it respects the JSON format.

- version: indicates the current version
- name: the application/package name
- description: a brief description of the app/package
- main: the entry point for the application
- scripts: defines a set of node scripts you can run
- dependencies: sets a list of npm packages installed as dependencies
- devDependencies: sets a list of npm packages installed as development dependencies

```
{
    "name": "package_demo",
    "version": "1.0.0",
    "description": "",
    "main": "index.js",
    "scripts": {
        "start": "node momentdemo.js"
     },
    "author": "Rujuan Xing",
    "license": "ISC",
    "dependencies": {
        "moment": "^2.29.1"
    },
    "devDependencies": {
        "eslint": "^7.28.0"
    }
}
```

Semantic Versioning



- The Semantic Versioning concept is simple: all versions have 3 digits: `x.y.z.`
  - the first digit is the major version
  - the second digit is the minor version
  - the third digit is the patch version
- When you make a new release, you don't just up a number as you please, but you have rules:
  - you up the **major** version when you make incompatible API changes
  - you up the **minor** version when you add functionality in a backward-compatible manner
  - you up the **patch** version when you make backward-compatible bug fixes

More details about Semantic Versioning

- Why is that so important?
  - Because `npm` set some rules we can use in the `package.json` file to choose which versions it can update our packages to, when we run `npm update`.

- The rules use those symbols:
  - `^`: it's ok to automatically update to anything within this major release. If you write `^0.13.0`, when running `npm update`, it can update to `0.13.1`, `0.14.2`, and so on, but not to `1.14.0` or above.
  - ~: if you write `~0.13.0` when running `npm update` it can update to patch releases: `0.13.1` is ok, but `0.14.0` is not.
  - `>`: you accept any version higher than the one you specify

package-lock.json

- Introduced by NPM version 5 to capture the exact dependency tree installed at any point in time.
- Describes the exact tree
- Guarantee the dependencies on all environments.
- Use `npm ci` if you want to use dependencies in package-lock.json file
- Don’t modify this file manually.
- Always use npm CLI to change dependencies, it’ll automatically update package-lock.json

```
{
  "name": "lesson03-demo",
  "version": "1.0.0",
  "lockfileVersion": 1,
  "requires": true,
  "dependencies": {
    "moment": {
      "version": "2.24.0",
      "resolved": "https://registry.npmjs.org/moment/-
/moment-2.24.0.tgz",
      "integrity": "sha512-
bV7f+6l2QigeBBZSM/6yTNq4P2fNpSWj/0e7jQcy87A8e7o2nAfP/34/2ky5
Vw4B9S446EtIhodAzkFCcR4dQg=="
    }
  }
}
```

More About Packages

- Development Dependencies: Needed only while I'm developing the app. It's not needed for running the app.
  - `npm install mocha --save-dev`

  `// notice devDependencies entry now in package.json`

- Global Dependencies: Available to all applications
  - `npm install -g nodemon`
  - `nodemon app.js //auto detects changes and restarts your project`

More npm CLI Commands

```
npm -v // will print npm version
npm init // will create package.json
npm install <package> --S // download & install the code from last commit of git repo
                                // "--save" option will update package.json automatically
                                // other options are: --save-dev (-D) --save-optional (-O)
npm i <package> -g  // download & install a package globally
npm i <package> --dry-run
npm ls -g --depth=0 // show all global packages in your system
npm update // check versions in package.json and update
npm i npm -g // update npm
npm outdated -g // show all outdated global packages
npm prune // if a package is installed without --save then delete and clean

npm config list l // display the default npm settings
npm config set init-author-name "Josh Edward"
npm config delete init-author-name
npm config set save true // automatically --save (-S)

npm search lint // search online for package with lint in the name
npm home <package> // open browser to package homepage
npm repo <package> // open browser to package repository
```

HTTP

Node as a Web Server

- Node started as a Web server and evolved into a much more generalized framework.
- Node `http` module is designed with streaming and low latency in mind.
- Node is very popular today to create and run Web servers.

Web Server Example

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

http.IncomingMessage
Implements `ReadableStream` Interface

http.ServerResponse
Implements `WritableStream` Interface

```
server.on('request', function(req, res) {
                            res.writeHead(200, {'Content-Type': 'text/plain'});
                            res.write('Hello World!');
                            res.end();
                     });
server.listen(3000);
```

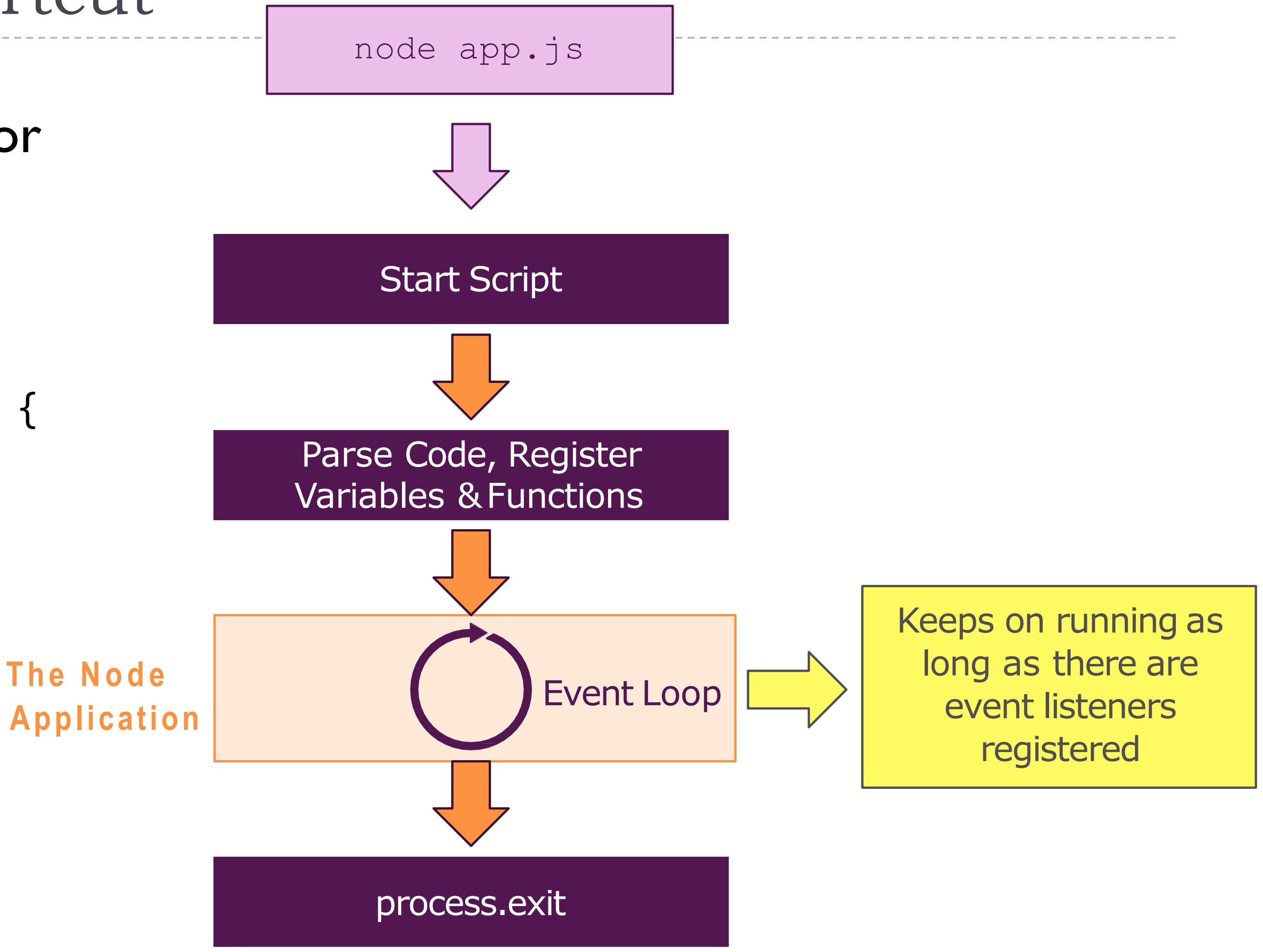
After we run this code. The node program doesn’t stop.. it keeps waiting for request

Web Server Example Shortcut

- Passing a callback function to `createServer()` is a shortcut for listening to "request" event.

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

http.createServer(function (req, res) {
    res.writeHead(200, { 'Content-
Type': 'application/json' });
    const person = {
        firstname: 'Josh',
        lastname: 'Edward'
    };
    res.end(JSON.stringify(person));
}).listen(3000, '127.0.0.1');
```


node app.js
Start Script
Parse Code, Register Variables & Functions
The Node Application
Event Loop
Keeps on running as long as there are event listeners registered
process.exit

Send out an HTML file

- What's the problem with the code below?

```
index.html
<html>
        <head></head>
        <body>
                <h1>{Message}</h1>
        </body>
</html>
```

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

http.createServer((req, res) => {
    res.writeHead(200, { 'Content-Type': 'text/html' });
    let html = fs.readFileSync(path.join(__dirname, 'index.html'), 'utf8');
    html = html.replace('{Message}', 'Hello from Node.js!');
    res.end(html);
}).listen(3000, '127.0.0.1', () => { console.log('listening on 3000...') });
```

Reading the file

- What's going to happened to the Node process in memory? Will this code still work with 2 GB file or more?

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

http.createServer((req, res) => {
    fs.readFile('./big.txt', (err, data) => {
        if (err) throw err;

        res.end(data);
    });
}).listen(3000, () => console.log('listening on 3000'));
```

A Simpler solution – Use Stream

- We can simply use stream.pipe(), which does exactly what we described.

```
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);
```

Understanding Request & Response

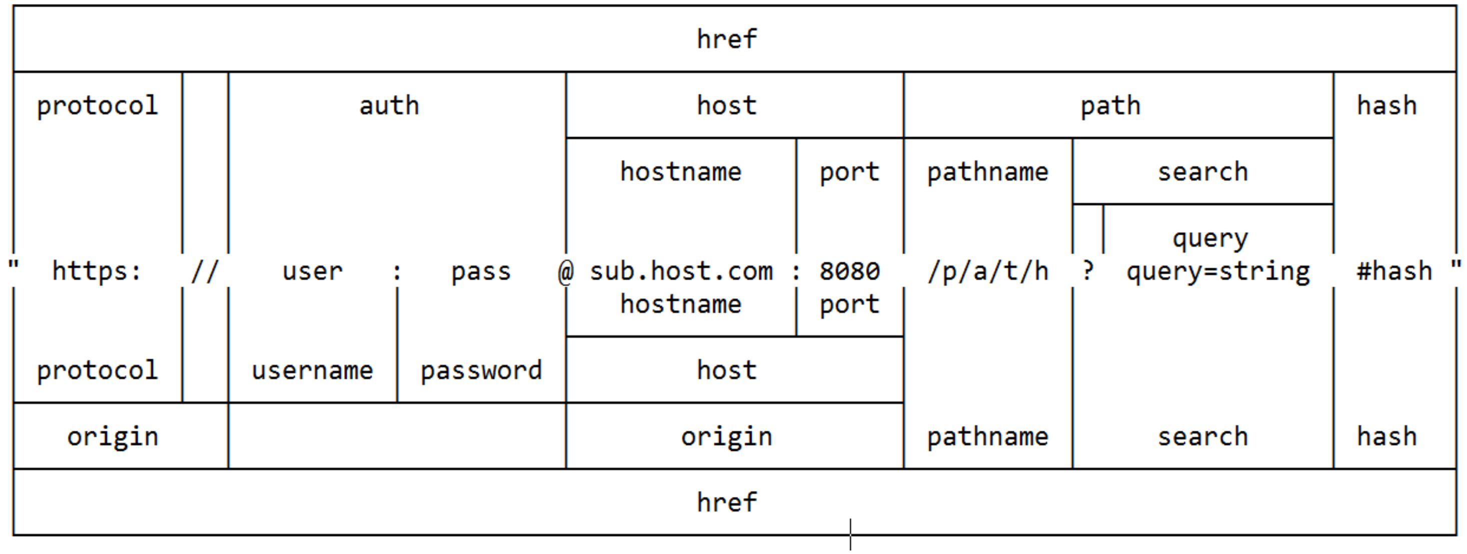
- A request message from a client to a server includes, within the first line of that message, the method to be applied to the resource, the identifier of the resource, and the protocol version in use.
- After receiving and interpreting a request message, a server responds with an HTTP response message.

```
const http = require('http');
http.createServer((req, res) => {
    console.log(req.url, req.method, req.headers);

    res.setHeader('Content-Type', 'text/html');
    res.write('<html>');
    res.write('<head><title>My First Page</title></head>');
    res.write('<body><h1>Hello From Node.js</h1></body>');
    res.write('</html>');
    res.end();
}).listen(3000);
```

HTTP Request: Reading Get and Post Data

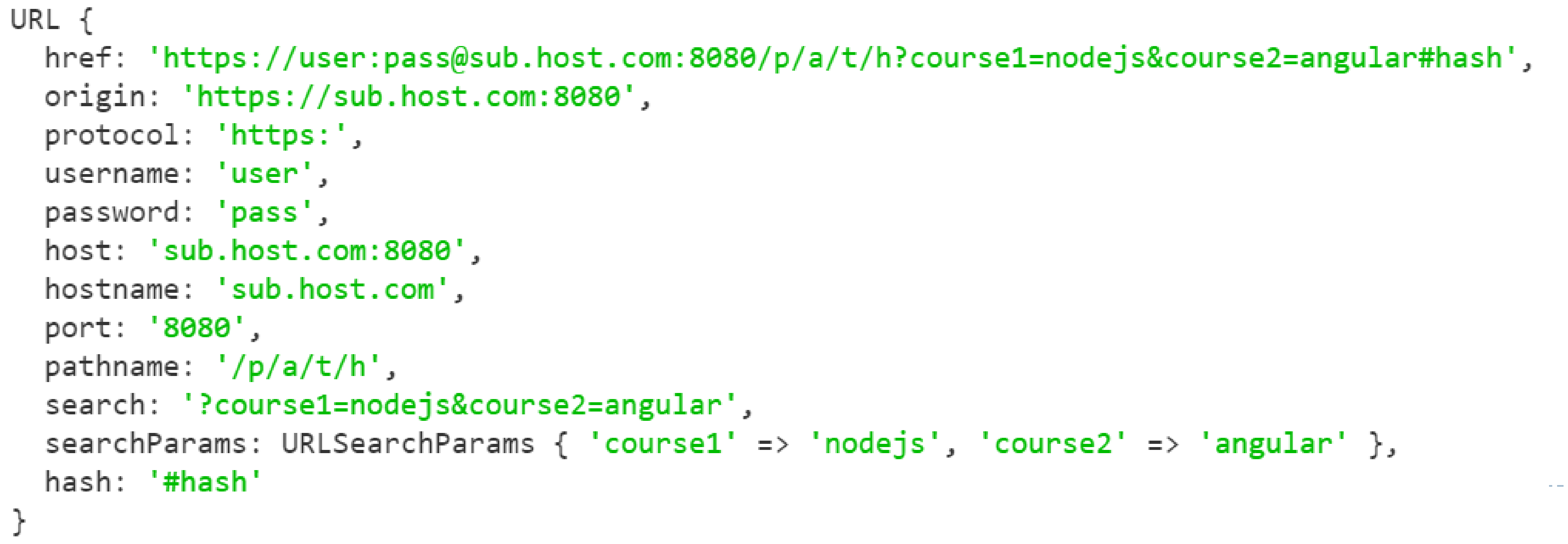
- Handling basic GET & POST requests is relatively simple with Node.js.
- We use the `url` module to parse and read information from the URL.
- The `url` module uses the WHATWG URL Standard (https://url.spec.whatwg.org/)



Using URL Module

- Parsing the URL string using the WHATWG API:

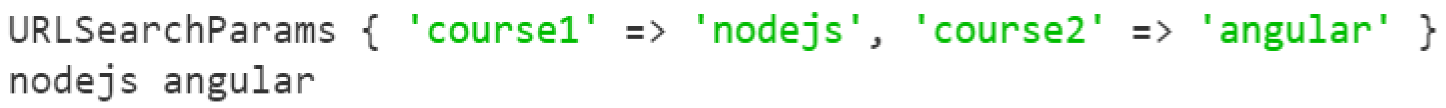
```
const url = require('url');
const myURL =
    new URL('https://user:pass@sub.host.com:8080/p/a/t/h?course1=nodejs&course2=angular#hash');
console.log(myURL);
```



```
URL {
  href: 'https://user:pass@sub.host.com:8080/p/a/t/h?course1=nodejs&course2=angular#hash',
  origin: 'https://sub.host.com:8080',
  protocol: 'https:',
  username: 'user',
  password: 'pass',
  host: 'sub.host.com:8080',
  hostname: 'sub.host.com',
  port: '8080',
  pathname: '/p/a/t/h',
  search: '?course1=nodejs&course2=angular',
  searchParams: URLSearchParams { 'course1' => 'nodejs', 'course2' => 'angular' },
  hash: '#hash'
}
```

Parsing the Query String

```
const url = require('url');
const myURL =
    new URL('https://user:pass@sub.host.com:8080/p/a/t/h?course1=nodejs&course2=angular#hash');
let params = myURL.searchParams;
console.log(params);
console.log(params.get('course1'), params.get('course2’));
```



```
URLSearchParams { 'course1' => 'nodejs', 'course2' => 'angular' }
nodejs angular
```

HTTP Request: Reading Post Data

- Handling POST data is done in a **non-blocking way**, by using asynchronous callbacks. Because POST requests can potentially be very large - multiple megabytes in size. Handling the whole bulk of data in one go would result in a blocking operation.
- To make the whole process non-blocking, Node.js serves our code the POST data in small chunks (**stream**), callbacks that are called upon certain events. These events are **`data`** (a new chunk of POST data arrives) and **`end`** (all chunks have been received).
- We need to tell Node.js which functions to call back to when these events occur. This is done by adding listeners to the `request` object

Reading Post Data & Routing Example

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

http.createServer((req, res) => {
    const url = req.url;
    const method = req.method;

    if (url === '/') {
        res.write('<html>');
        res.write('<head><title>Enter Message</title></head>');
        res.write('<body><form action="/messsage" method="POST">Enter Message: <input name="message"><button type="submit">Send</button></form></body>');
        res.write('</html>');
        res.end();
    } else if (url === '/messsage' && method === 'POST') {
        const body = [];
        req.on('data', (chunk) => {
            body.push(chunk);
        });
        req.on('end', () => {
            const parsedBody = Buffer.concat(body).toString();
            console.log(parsedBody);
        });
        res.end('Done');
    }
}).listen(3000);
```