JAVASCRIPT ON THE SERVER. A NODE.JS CRASH COURSE

Group A
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AGENDA

1. Node.JS crash course – theoretical background
    1. Node.JS and microprocessors
    2. Node.JS basics
    3. Parts of Node.JS
    4. Tools for Node.JS development
2. Node.JS crash course – live coding
    1. Building a complete conference website with Node.JS
    2. Scraping smashingconf.com website
3. Project roundup – scraping structured data
    1. Our Experiences, remarks, takeaways

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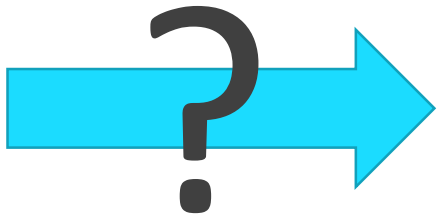
BEFORE DIGGING DEEPER…

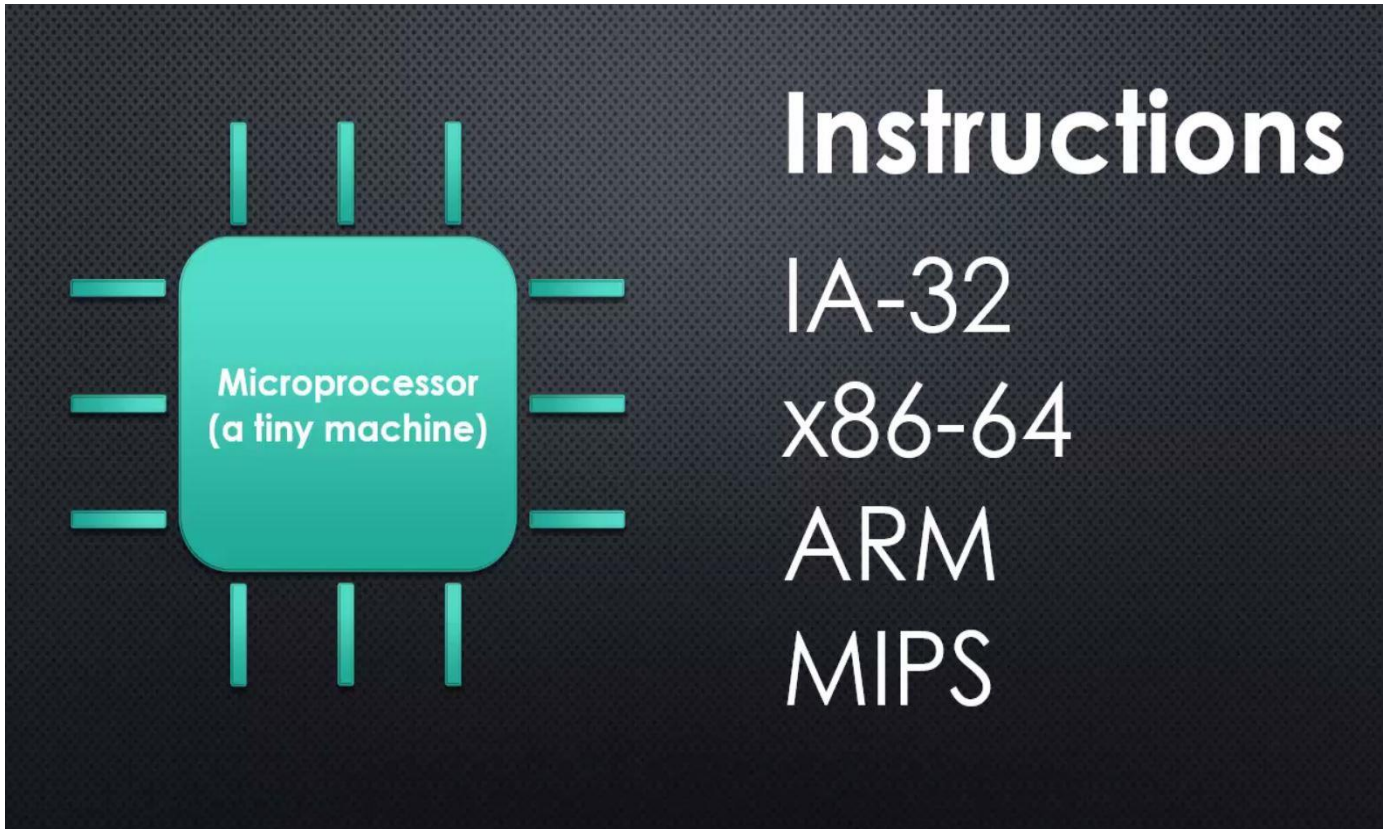
- Processors
- Machine code
- C++

… and Node.JS?

NODE.JS IS CONVERTED IN TO MACHINE CODE?

Node.JS

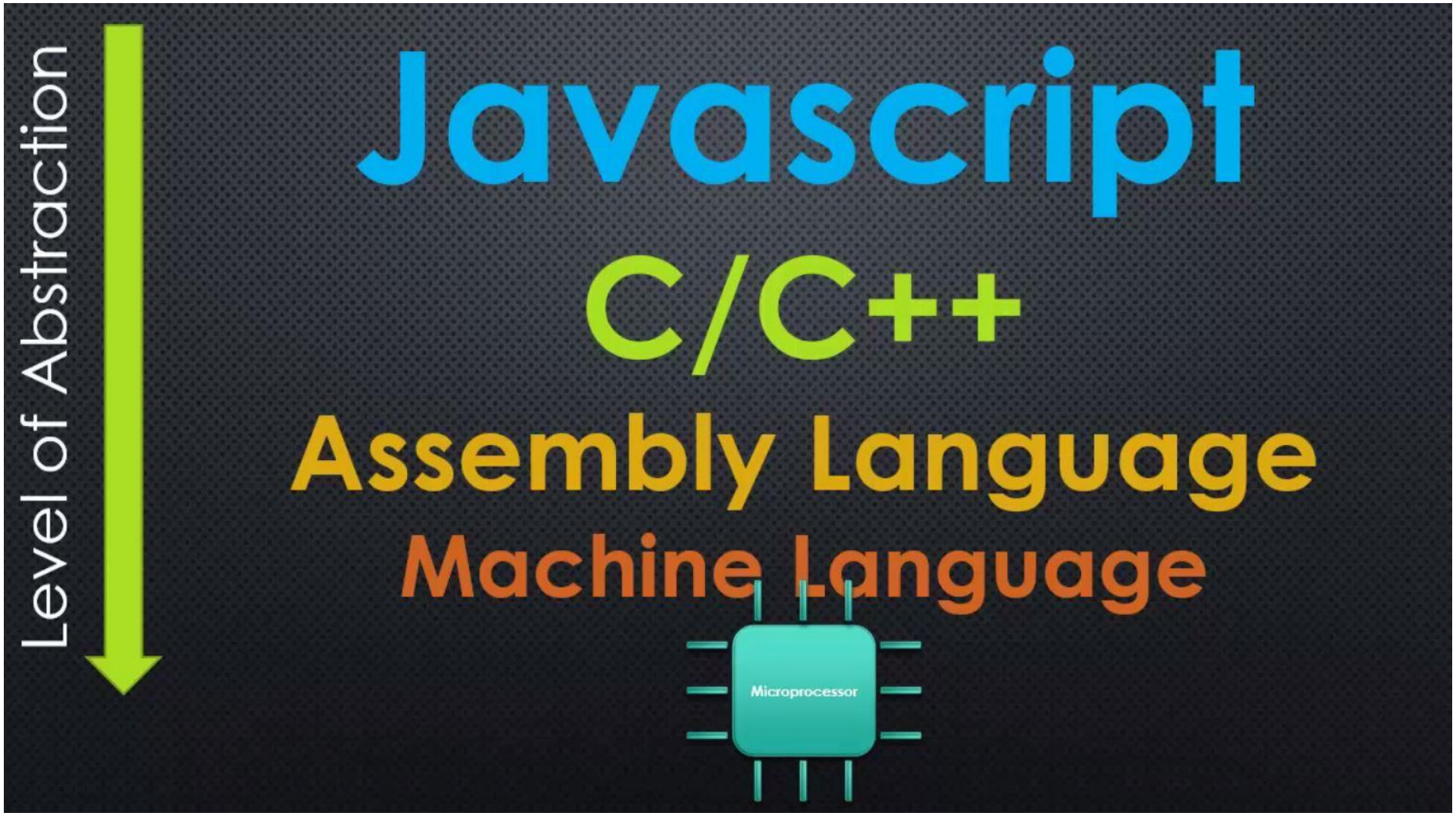




LET’S BUILD A FACEBOOK!

```
000018A45438100      0  55                push rbp
0000018A45438101     1  4889e5            REX.W movq rbp,rsp
0000018A45438104     4  56                push rsi
0000018A45438105     5  57                push rdi
0000018A45438106     6  41ff75a8          push [r13-0x58]
0000018A4543810A    10  56                push rsi
0000018A4543810B    11  49baf9552c7e8f010000 REX.W movq r10,
0000018F7E2C55F9    ;;  object: 0000018F7E2C55F9
0000018A45438115    21  4152              push r10
0000018A45438117    23  6a00              push 0x0
0000018A45438119    25  b803000000        movl rax,000000000000
```

NODE.JS IS NOT HERE ☹



PUBLIC QUESTION #1

In which Language NodeJS is written?

C++

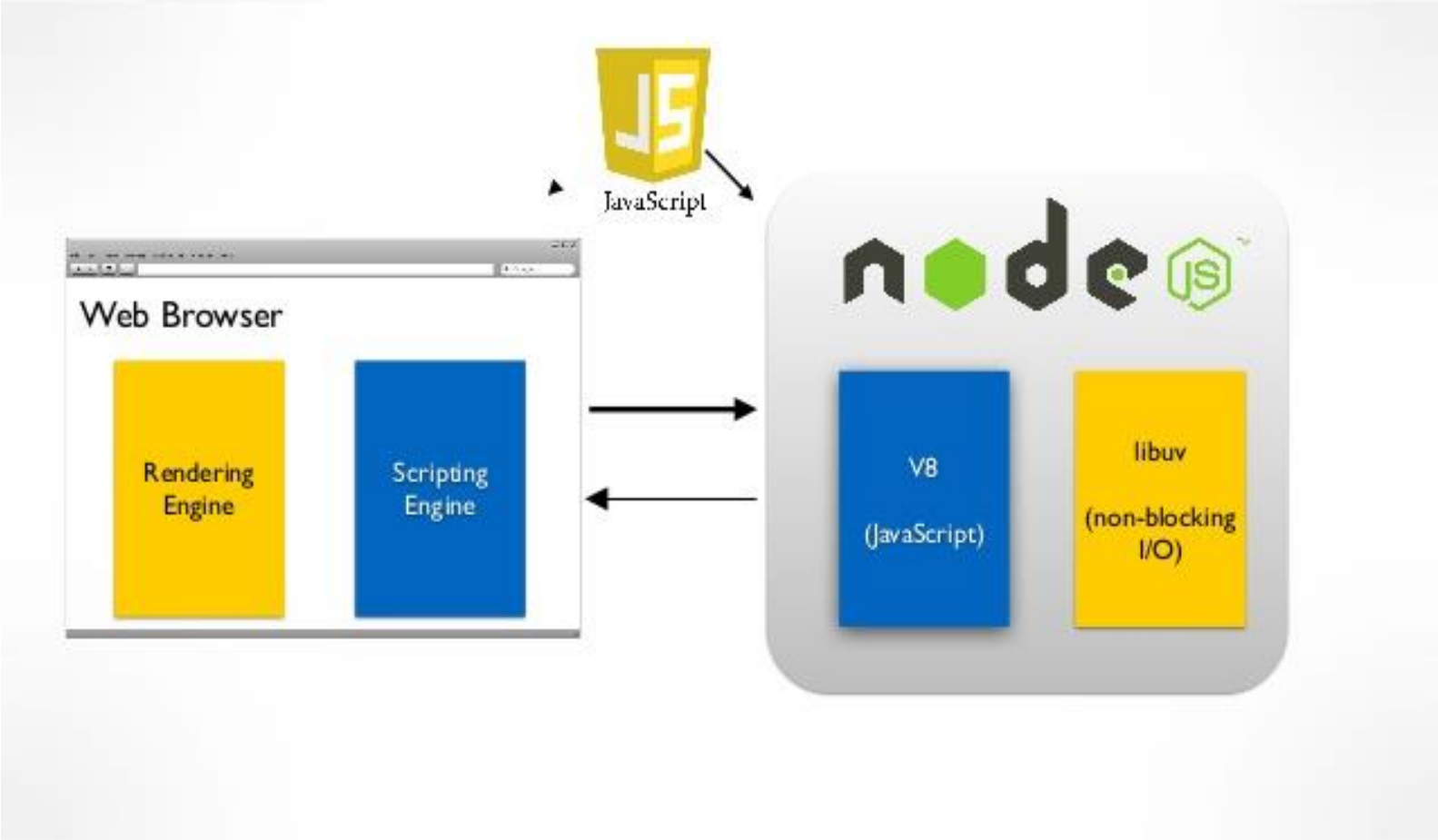
PUBLIC QUESTION #2

Why?

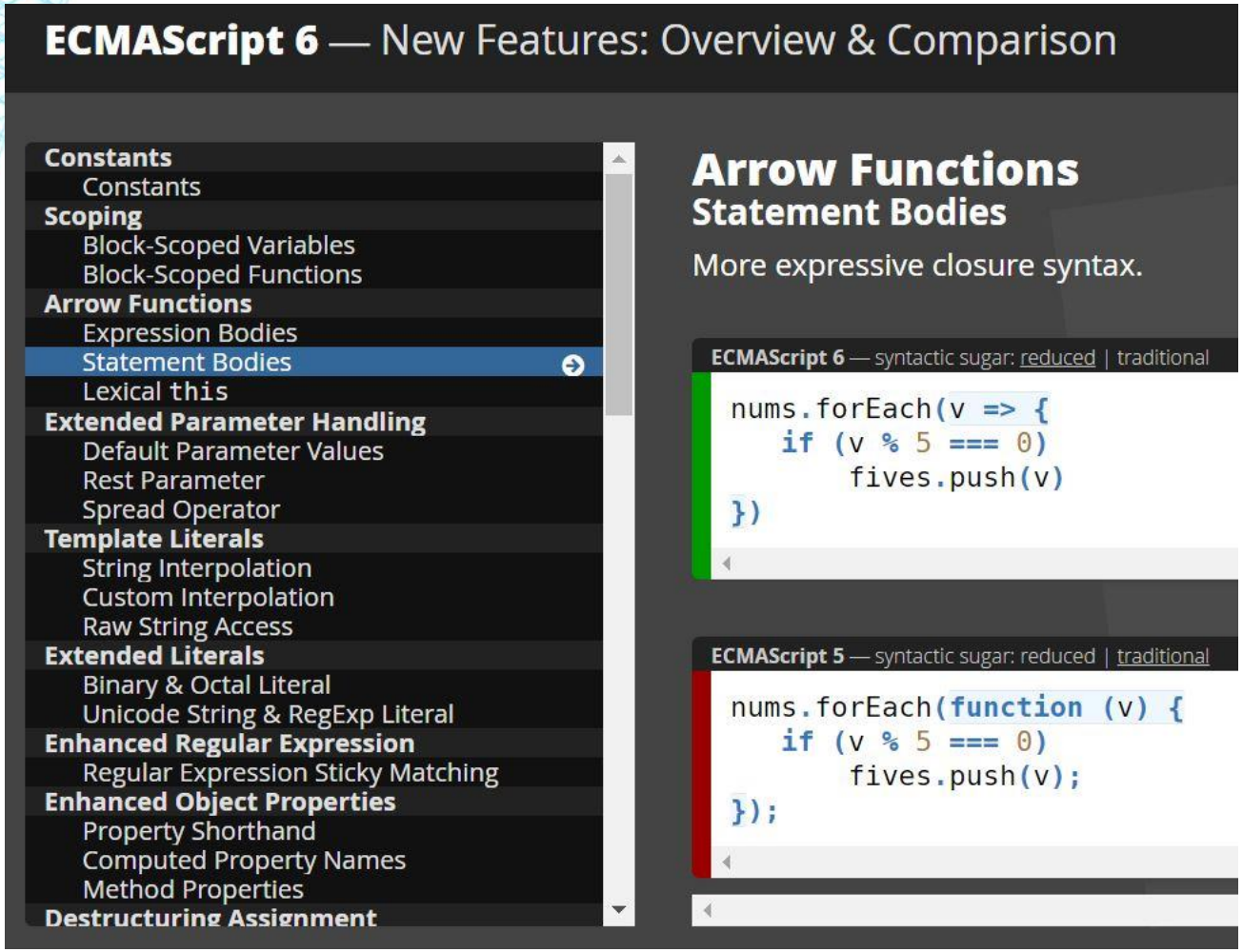
Because V8 is written in C++!

V8 – JS ENGINE DEVELOPED BY GOOGLE

- Used by Google Chrome
- Open source: https://github.com/v8/v8
- Contains bunch of C++ code
- Converts JavaScript code to machine code



ECMASCRIPT RULES EVERYTHING



- ECMAScript: standard how Javascript should work and is translated to machine code
- JavaScript: the actual programming language
- Current version: ECMA-262, 7th Edition, ECMAScript 2016 https://www.ecma-international.org/publications/files/ECMA-ST/Ecma-262.pdf

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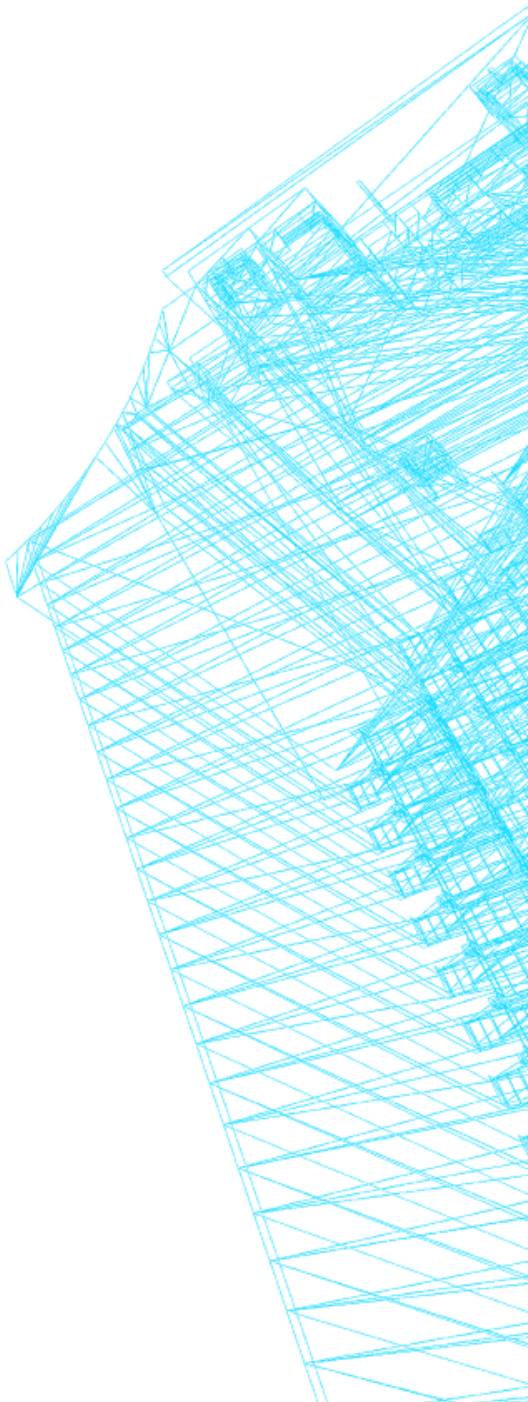
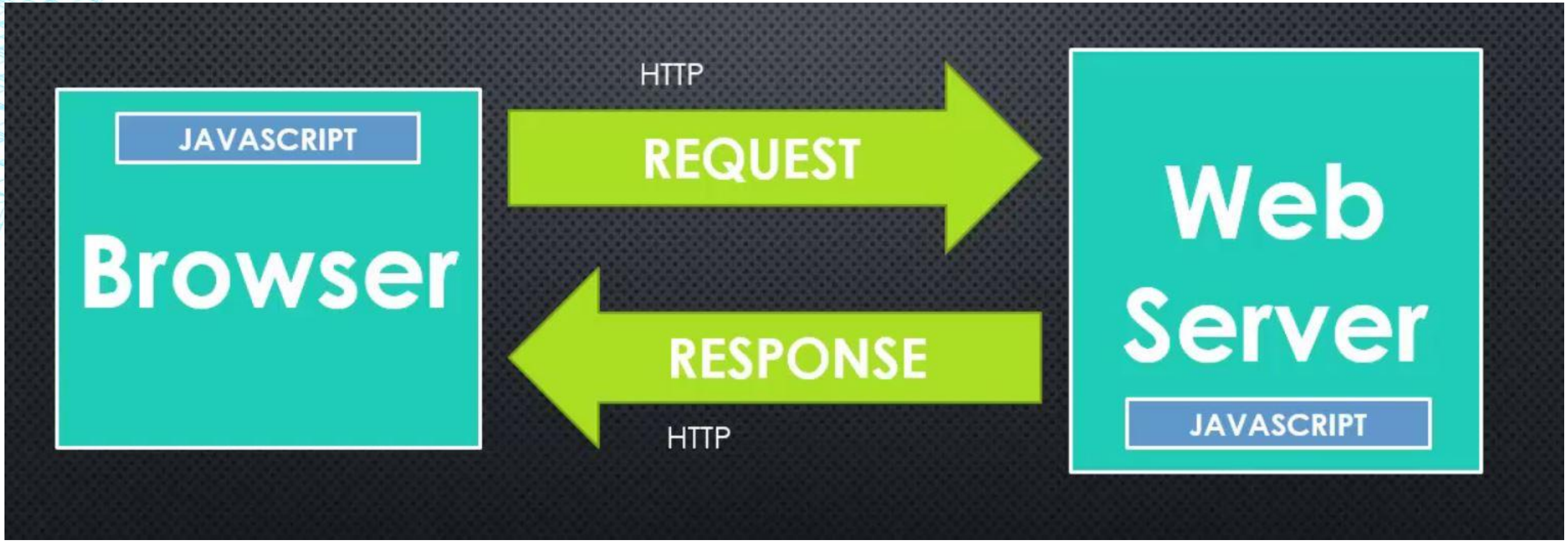
NODE.JS

For Beginners



SERVER-CLIENT COMMUNICATION IN NODE.JS

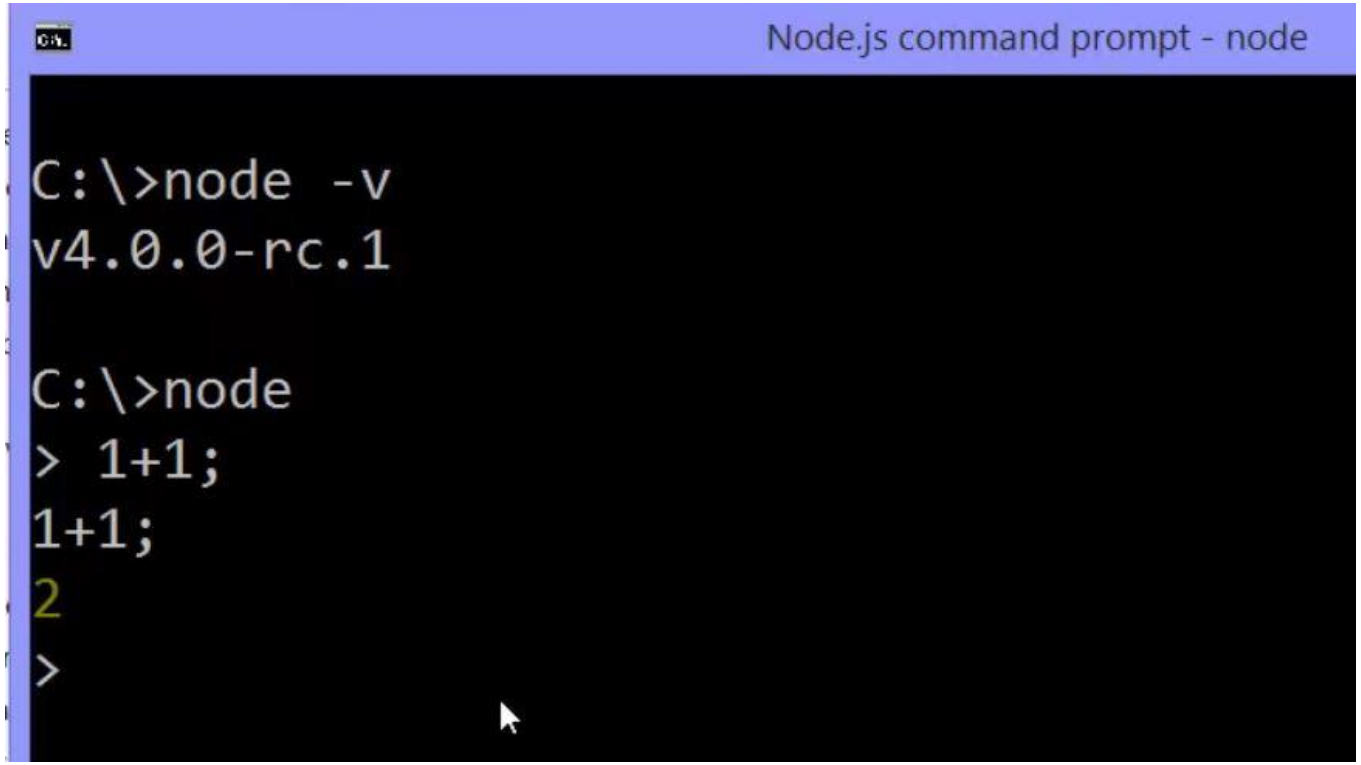


WHAT DOES JS NEED TO MANAGE A SERVER?

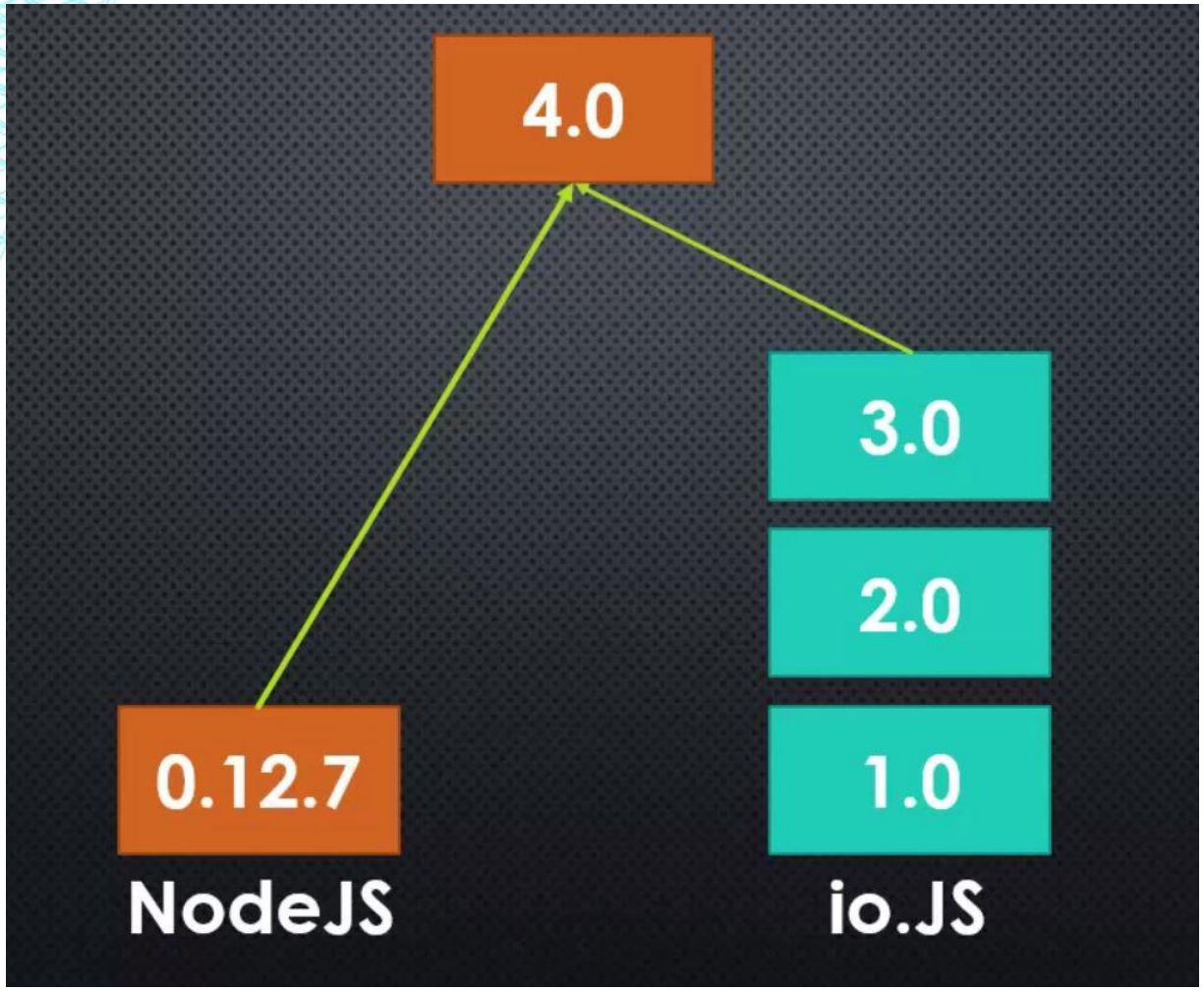
- Better ways to organize our code into reusable pieces
- Ways to deal with files
- Communicate over the internet
- Accept requests and send responses in the standard format
- Deal with databases
- Deal with work that takes a long time

YOUR FIRST NODE.JS PROGRAM

- Download Node.JS at https://nodejs.org
- Check the version with "node –v"
- The code gets compiled in the V8 engine and sent back



VERSIONS OF NODE.JS



- First version of Node.JS in late 2009
- Created by the engineers at “Joyent”
- Later was renamed to io.JS, but was merged with NodeJS again 2 years ago
- Current version 7.7.2

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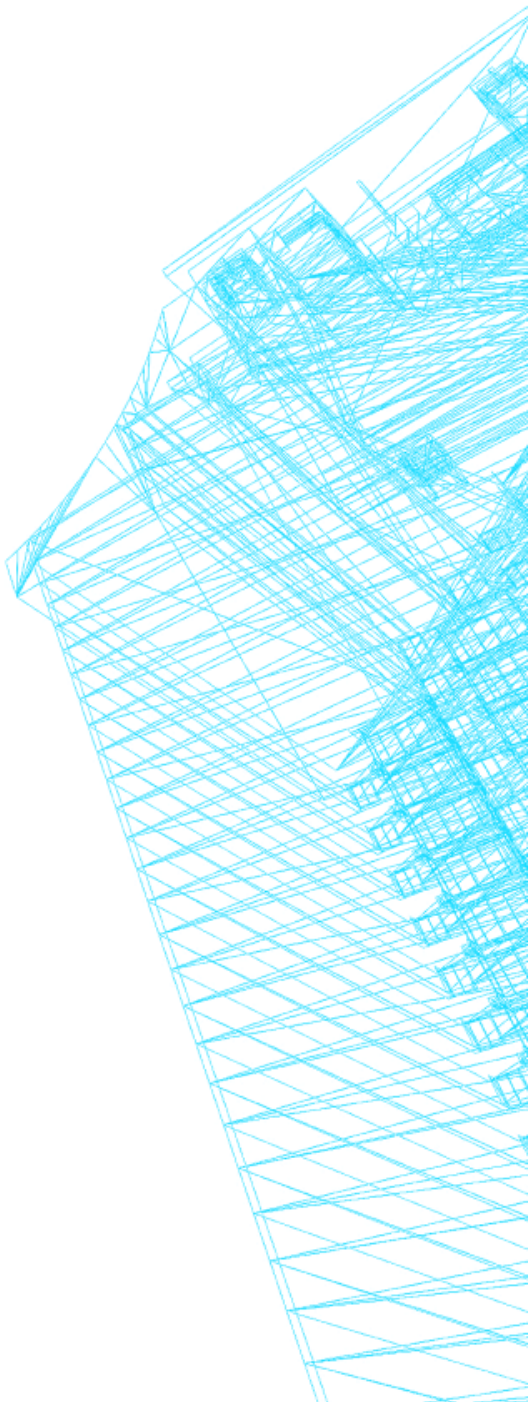
PARTS OF NODE.JS

For Intermediate



MODULES

- Reusable block of code
- Aligns with CommonJS ecosystem
- Exports specific objects, making them available for other modules

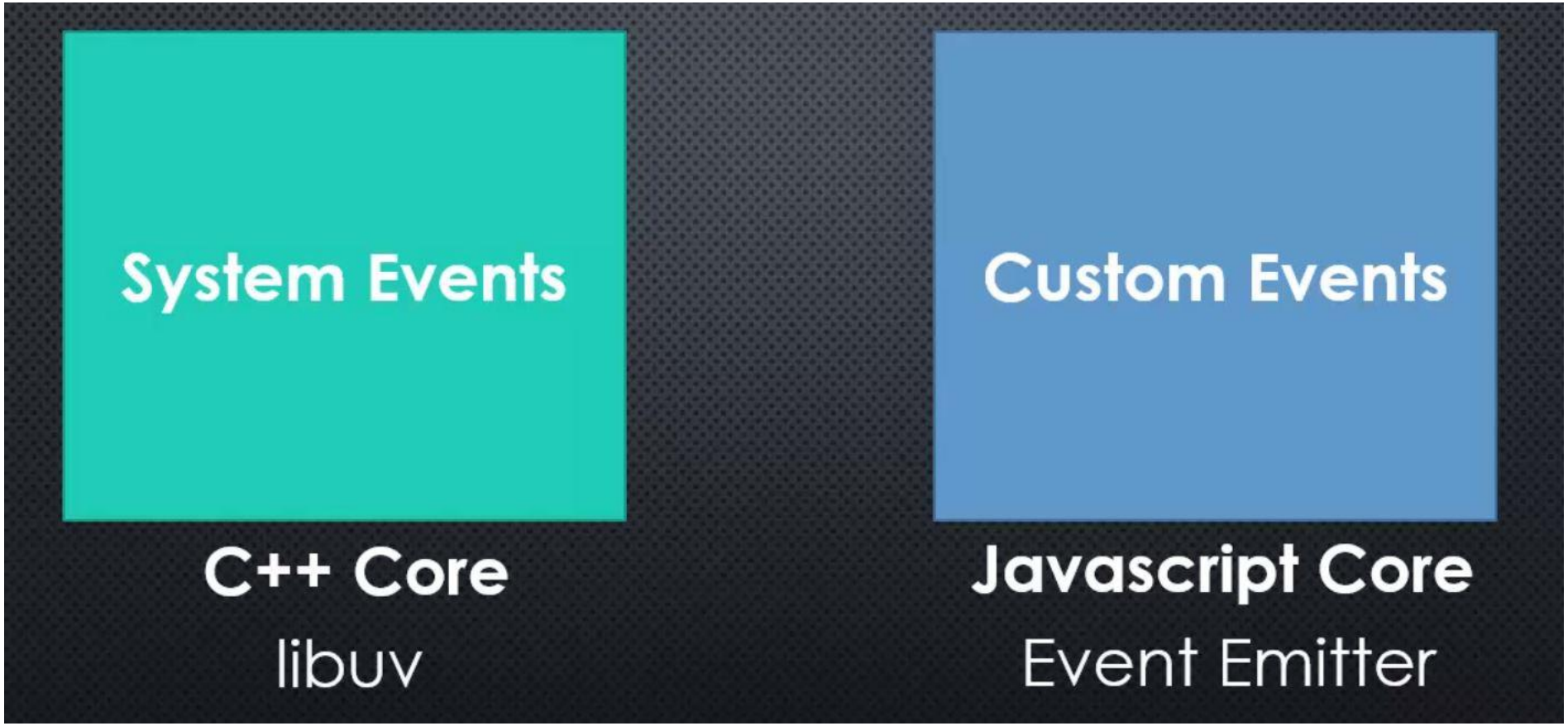
HOW MODULES ARE USED?

```
function add(){
    return x+y;
}

function subtract(){
    return x-y;
}

module.exports = {
  add: add,
  sub: subtract
};
```

This is what get exposed outside of your module's closure

```
var utils = require('./utils.js');

console.log(utils.add(1,100));
console.log(utils.sub(100,1));
```

EVENTS IN NODE.JS



EVENTS

- **Console** “Somewhere, someone said hello”, whenever the function **greet()** is called in our code

• app.js - nodejs - Visual Studio Code

• app.js

```
1 var Emitter = require('./emitter');
2
3 var emtr = new Emitter();
4
5 emtr.on('greet', function() {
6     console.log('Somewhere, someone said hello.');
7 });
```

PUBLIC QUESTION #3

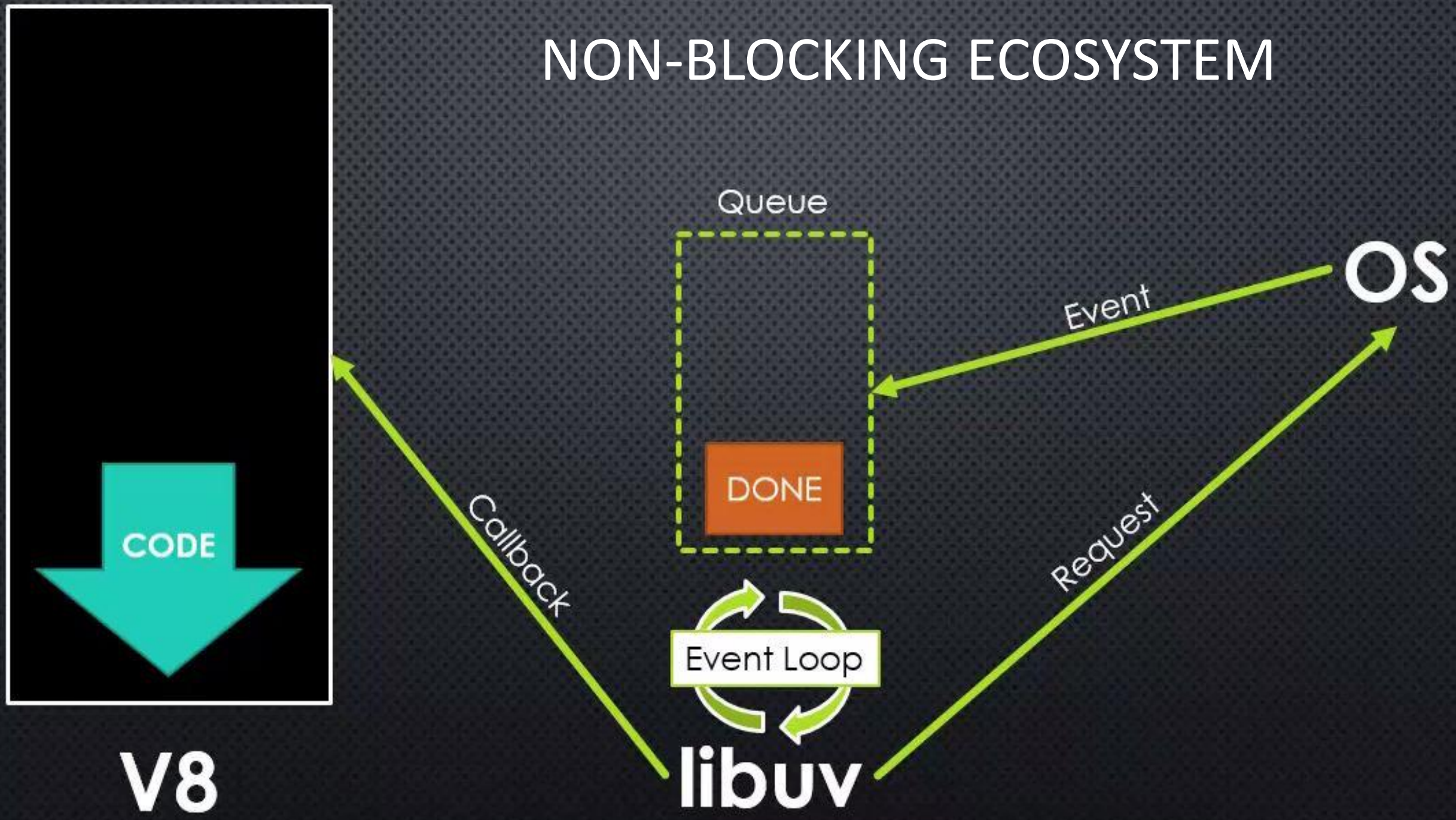
Is JavaScript synchronous or asynchronous?

Synchronous

SYNCHRONOUS CODE VS ASYNCHRONOUS

- Asynchronous process or asynchronous program is when more than one process is running simultaneously
- In JS, only one line of code executed at a time
- However, NodeJS is asynchronous

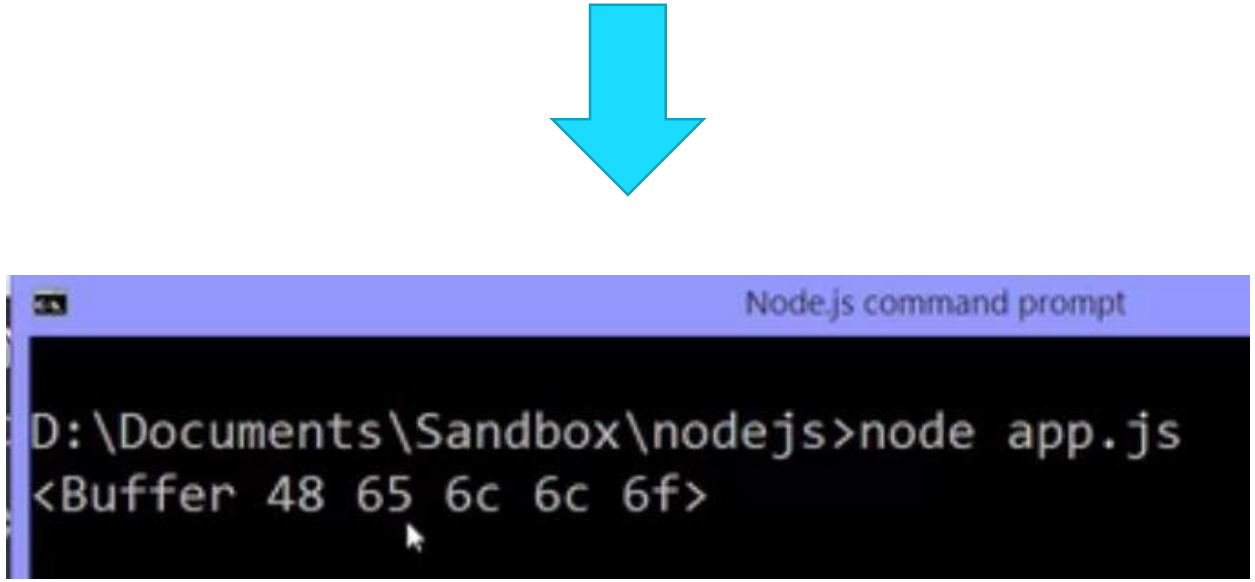
NON-BLOCKING ECOSYSTEM



BUFFERS AND FS

- Reads and manipulates streams of binary data
- Work in background of the “fs” library
- We can also write data into buffers by ourselves!

```
var buf = new Buffer('Hello', 'utf8');
console.log(buf);
```



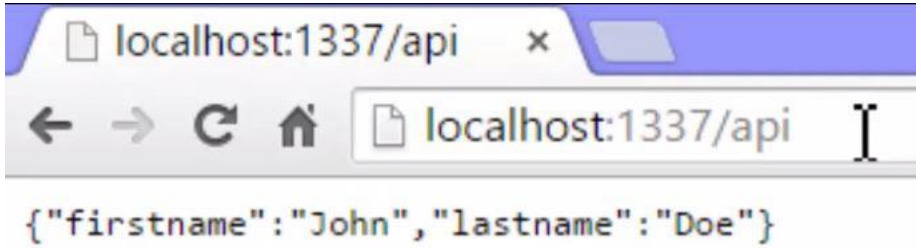
CALLBACKS

- A Callback is an inherent part of Node.JS
- Called whenever the main function terminates
- Returns error as its first parameter and response as a second parameter

HTTP REQUESTS AND RESPONSES

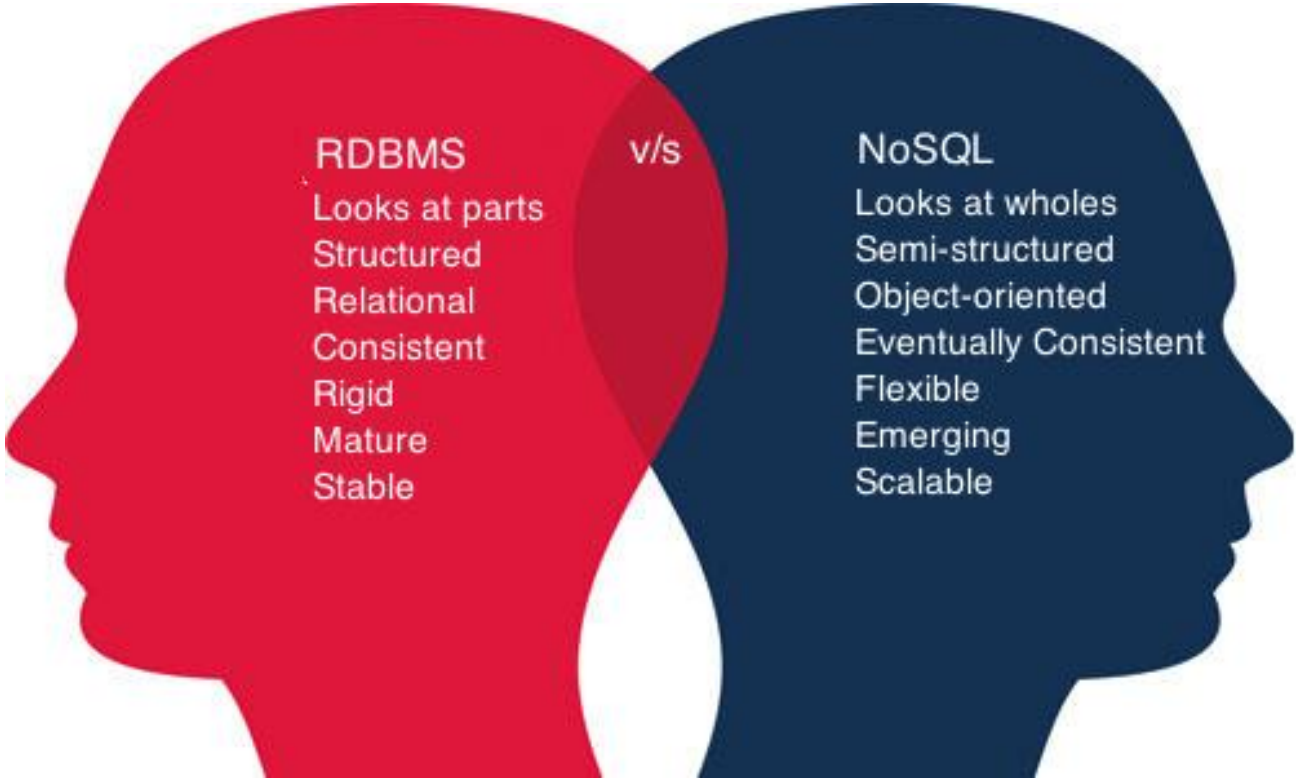
app.js

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

http.createServer(function(req, res) {

    if (req.url === '/api') {
        res.writeHead(200, { 'Content-Type': 'application/json' });
        var obj = {
            firstname: 'John',
            lastname: 'Doe'
        };
        res.end(JSON.stringify(obj));
    }

}).listen(1337, '127.0.0.1');
```



NODE.JS AND DATABASES

- SQL and NoSQL possible
- Integrates easily with MongoDB that forms a part of the MEAN stack
- NoSQL – provides flexibility, ideal to hold the web data e.g. : photos , videos, blogs
- Mongoose – simple solution to model application data



WHAT DOES JS NEED TO MANAGE A SERVER? (AGAIN)

- Better ways to organize our code into reusable pieces ✓
- Ways to deal with files ✓
- A way to deal with work that takes a long time ✓
- The ability to communicate over the internet ✓
- The ability to accept requests and send responses in the standard format ✓
- Ways to deal with databases ✓

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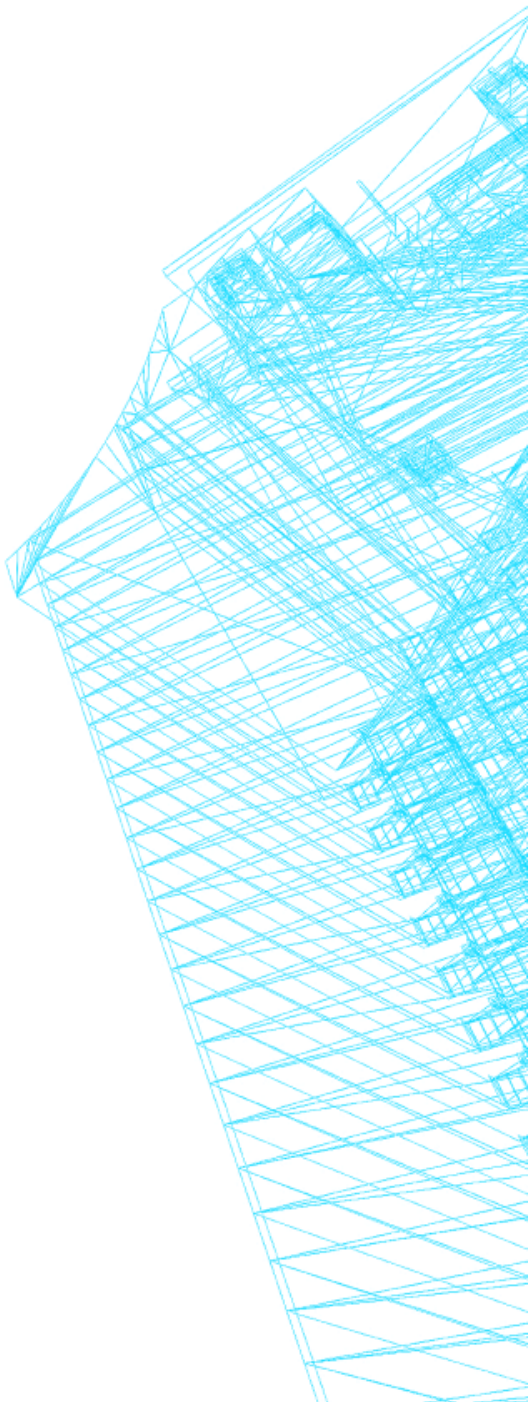
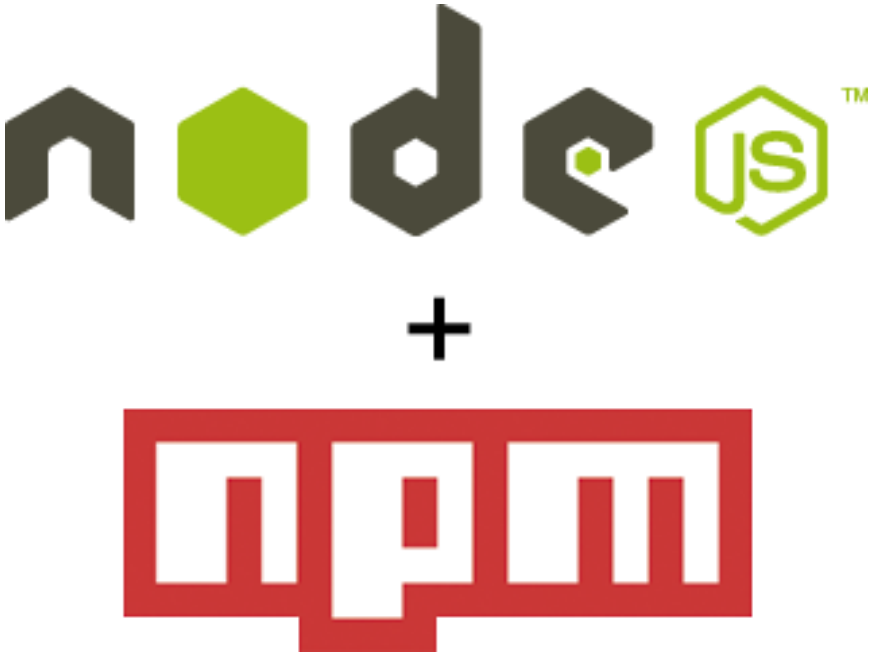
PACKAGE MANAGERS, TASK RUNNERS, FRAMEWORKS…

For Advanced



NPM – NODE PACKAGE MANAGER



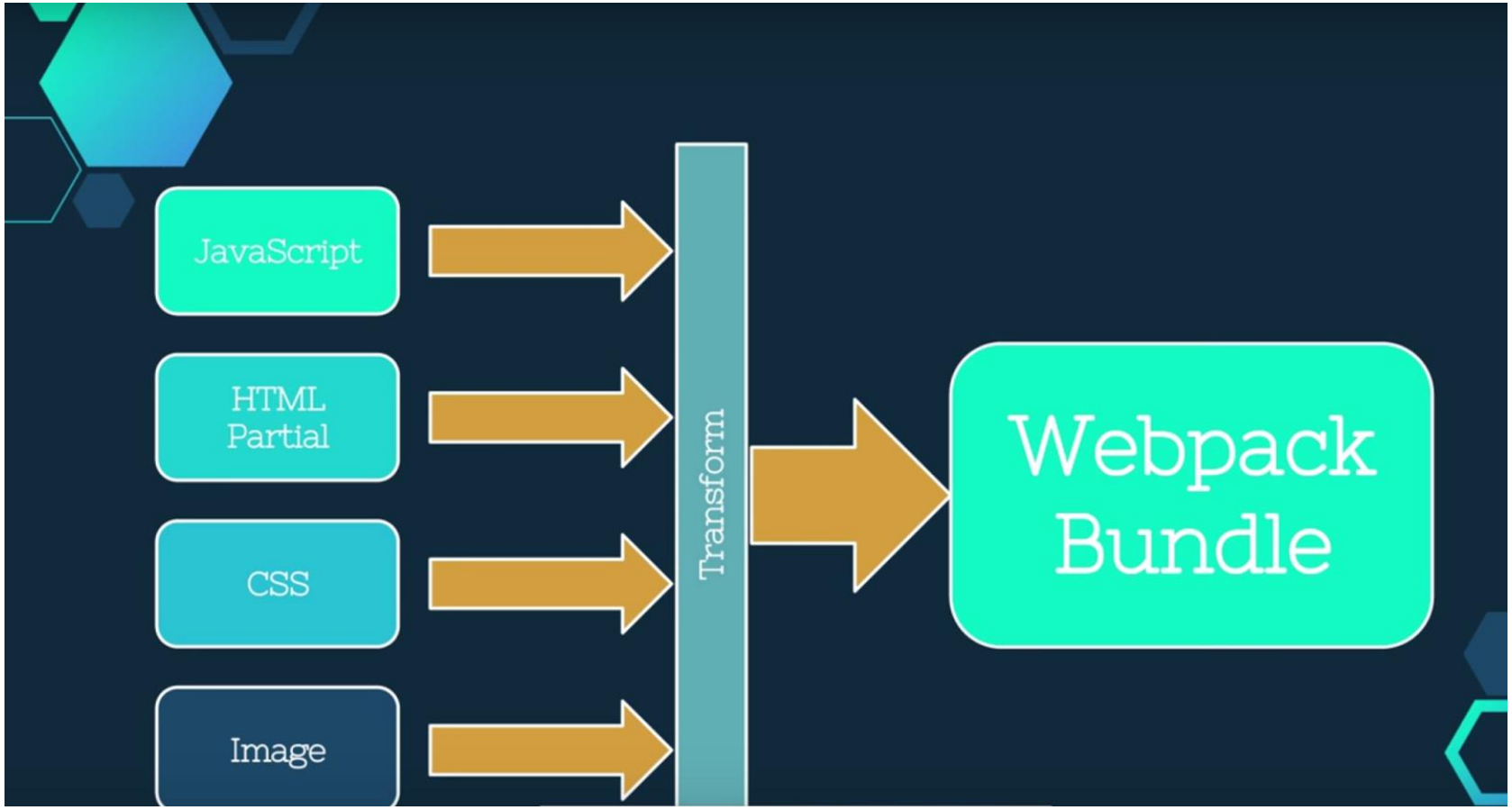
- NPM manages dependencies
- Updates packages when needed
- npm makes it easy for JavaScript developers to share and reuse code

HOW VERSIONING WORKS

1. Update **from 1.7.0 to 1.7.1** - some bugs were fixed, your code will work fine
2. Update **from 1.7.1 to 1.8.0** - some new features were added, your code will still work just fine
3. Update **from 1.8.0 to 2.0.0** - big changes, your code will probably break

WEBPACK

- Converts your static assets to a bundle
- Supports hot module reloading
- Works very well with React framework



GULP

```
[14:01:18] Using gulpfile C:\[redacted]\formdata\gulpfile.js
[14:01:18] Starting 'watch-test'...
[14:01:18] Finished 'watch-test' after 45 ms
[14:01:32] Starting 'test'...


  Home page
    - should load the page properly
    - should navigate to login
    - should navigate to sign up
    - should load analytics


  0 passing (13ms)
  4 pending

[14:01:32] Finished 'test' after 70 ms
```

- Automates the common tasks while building applications
- With Gulp you can: minimize CSS, convert LESS to CSS, make certain modifications on certain conditions

PACKAGES WE USE

- ExpressJS
- Nodemon
- Moment
- Request

EXPRESS

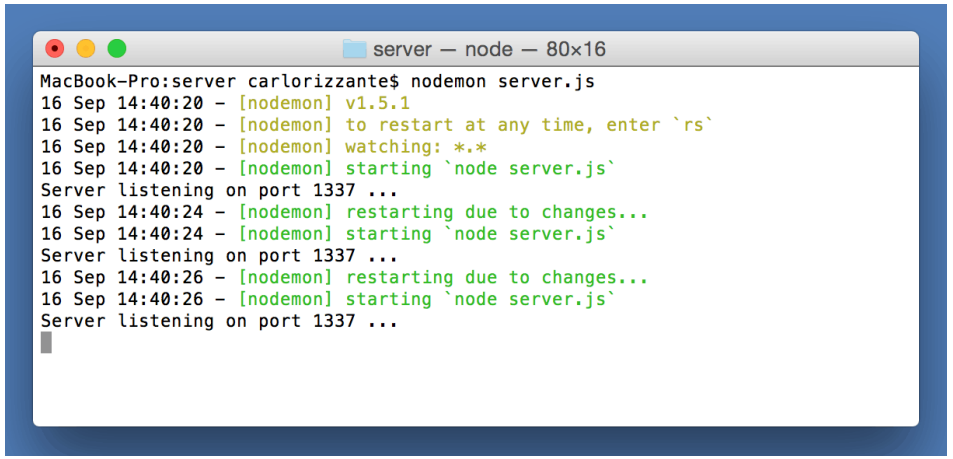
- Helps to organize your app into MVC structure
- Allows usage of any templating language
- Part of the MEAN stack
- Routing made easyyyy…

```
// GET method route
app.get('/', function (req, res) {
  res.send('GET request to the homepage')
})

// POST method route
app.post('/', function (req, res) {
  res.send('POST request to the homepage')
})
```

NODEMON

- Watches for changes in the file directory and restarts the app if needed



MOMENT

Format Dates

```
moment().format('MMMM Do YYYY, h:mm:ss a'); // March 10th 2017, 4:49:48 pm
moment().format('dddd');                    // Friday
moment().format("MMM Do YY");               // Mar 10th 17
moment().format('YYYY [escaped] YYYY');     // 2017 escaped 2017
moment().format();                          // 2017-03-10T16:49:48+01:00
```

- Parses, manipulates, validates and formats dates

REQUIRE

```
var request = require('request');
request('http://www.google.com', function (error, response, body) {
  console.log('error:', error); // Print the error if one occurred
  console.log('statusCode:', response && response.statusCode); // Print the response
status code if a response was received
  console.log('body:', body); // Print the HTML for the Google homepage.
});
```

- Library that allows us to make simple HTTP calls
- It returns the DOM structure of the website that could be used e.g. for scraping
- Important part of our work

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THE PROJECT SCOPE

- At first there was…

?

THE PROJECT SCOPE

- Extract data from structured online resources:
  - DBPedia
  - WorldCat
  - MusicBrainz
  - IMSLP
  - …
- Define a vocabulary for Team 2
- Set up a database
- Populate the database with the structured data
- Create a REST API to access the database

PROBLEMS ALONG THE WAY

Extract data from structured online resources

- Some databases are harder to scrape than others
- Obviously, every script differs since the structure of each website differs
- And the winner in the category “most effort” is…

PROBLEMS ALONG THE WAY

PROBLEMS ALONG THE WAY

Issues with DBPedia:

- Tried Sparkle queries first, failed
- No structured overview, just some lists (17th_century_classical_musicians, classical_musicians_by_nationality, classical_musicians_by_instruments_and_nationality, …)
- All lists differ in structure
- Even the resulting artist pages differ in structure (i.e. 4 different fields, that **could** contain “date of birth”)
- Some fields missing, i.e. nationality which could sometimes be extracted from the list URL one level above (if list was named “American_classical_pianists”)

PROBLEMS ALONG THE WAY

- Define a vocabulary for Team 2:
  - What is meant by the term “vocabulary”
    - Words that are in context with “classical music”?
    - All the data we scraped including all attributes?
    - A plain list of entity names regardless of their meaning?
- Set up a database:
  - Which database is best for our purposes ?
  - How do we set up our PostgreSQL db?

PROBLEMS ALONG THE WAY

- Populate the database with the structured data:
  - handle differences in structure since data is aggregated from different databases
  - …and then do it all again with Sequelize
- Create a REST API to access the database:
  - Learn about REST APIs
  - Write the code
  - … and then do it all again with Sequelize + Swagger

LESSONS LEARNED

- It is tough to work towards a goal if you do not know exactly where you are heading
- Many helpful packages/frameworks, but you need to find and learn them first
- Tools should be known upfront, otherwise a lot of additional effort
- Earlier technical meeting to clarify questions, such that everyone has the same picture in mind

THANKS FOR YOUR ATTENTION!

WE WOULD BE HAPPY TO ANSWER SOME QUESTIONS

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