Adv Web Dev Architecture
Lecture 4

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Outline

- Review
- 1- Server and server scripting
- 2- Node js
- 3- JS is asynchronous, single threaded, restaurant analogy
- 4- Node.js installation
  - Node.js debugging in VSC (Visual Studio Code)
  - Node.js examples
    - Hello World!
- 5- Module (put your functions in module, just like including js external files), examples
- 6- using built in modules, examples
  - http
  - url
  - fs
- 7- Hosting Node js in shared hosting services, example

Review

- Hoisting
- Functions with no return statement, return undefined !
- JS is asynchronous, single threaded, non-blocking!
- Difference between GET and POST
- In JS a function can return a function

- every team member should have a comprehensive understanding of the entire project, including the work done by their fellow teammates,

Code of conduct

- Every team member should have a comprehensive understanding of the entire project, including the work done by their fellow teammates.

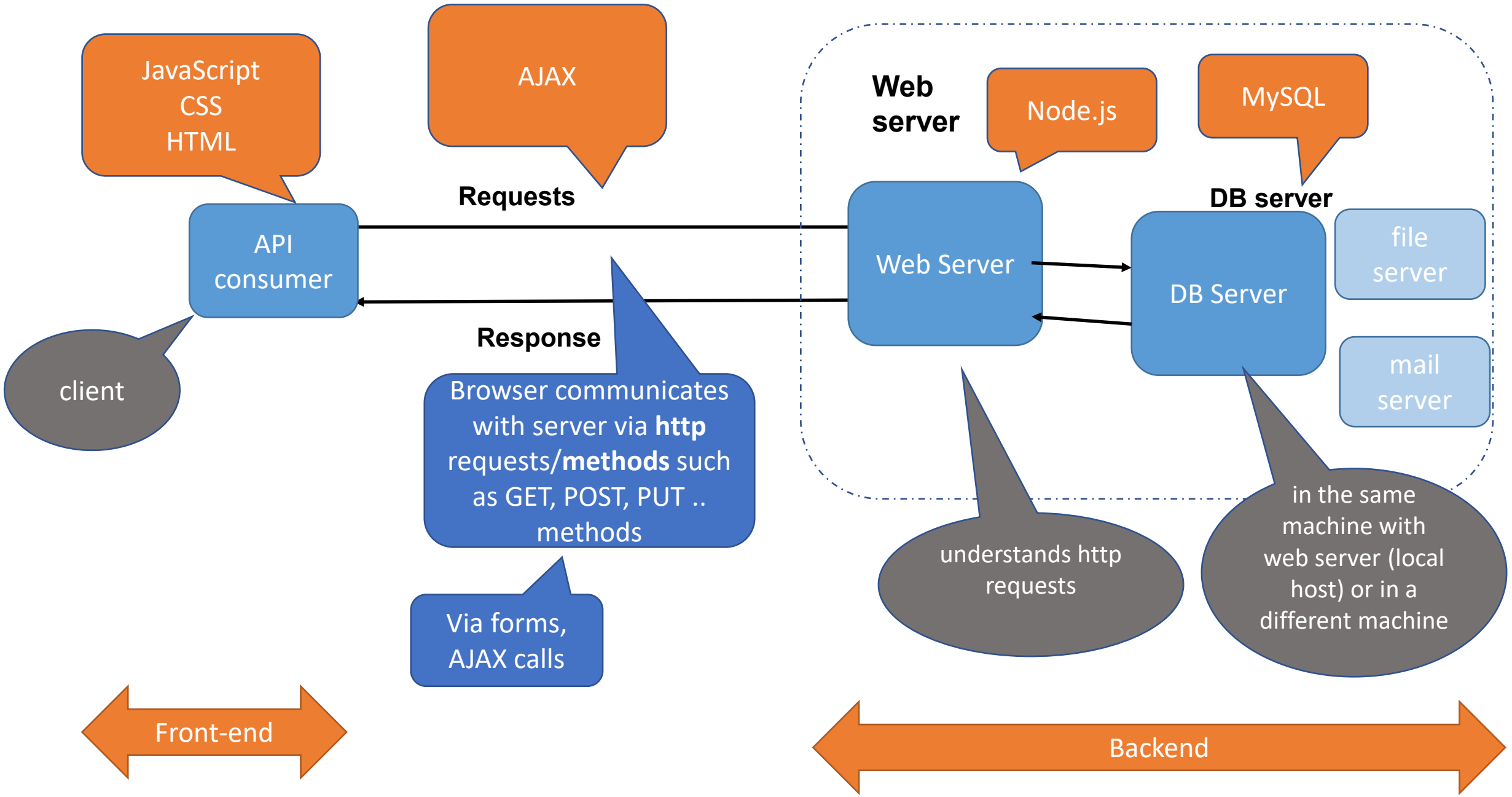
Server and server scripting

What is a server?

- A server is a computer (or computers) running 24/7 and accessible via the internet
- When a client such as a browser or mobile app sends a requests via protocol such as http, ftp etc, the server looks for the application responsible to deal with that request, and returns the response using those protocols

- In this course, the request from clint to server are carried using http methods such as GET, POST etc.

What is a server?



What a server side scripting language can do?

- It can create a webserver to
- generate dynamic page content
- E.g. opening wordpress.com/index.php at borwser
  - sends a request to the server,
  - The server looks for an app to run php files
  - If the php server is installed it runs that file and returns the result in the form of html
- Server side script can create, open, read, write, delete, and close **files** on the server
- Server side script can collect form data
- Server side script can add, delete, modify data in your **database**

In this course, we are going to use

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node.js

for
server side (backend) scripting

What is Node.js?

- Node.js is an open source, free, server environment that uses JavaScript on the server side

- Node.js is an **open-source**, **cross-platform**, back-end JavaScript **runtime environment** that runs on the
- **Chrome V8** engine
- and executes JavaScript code **outside a web browser**

https://en.wikipedia.org/wiki/Node.js

Why nodeJS?

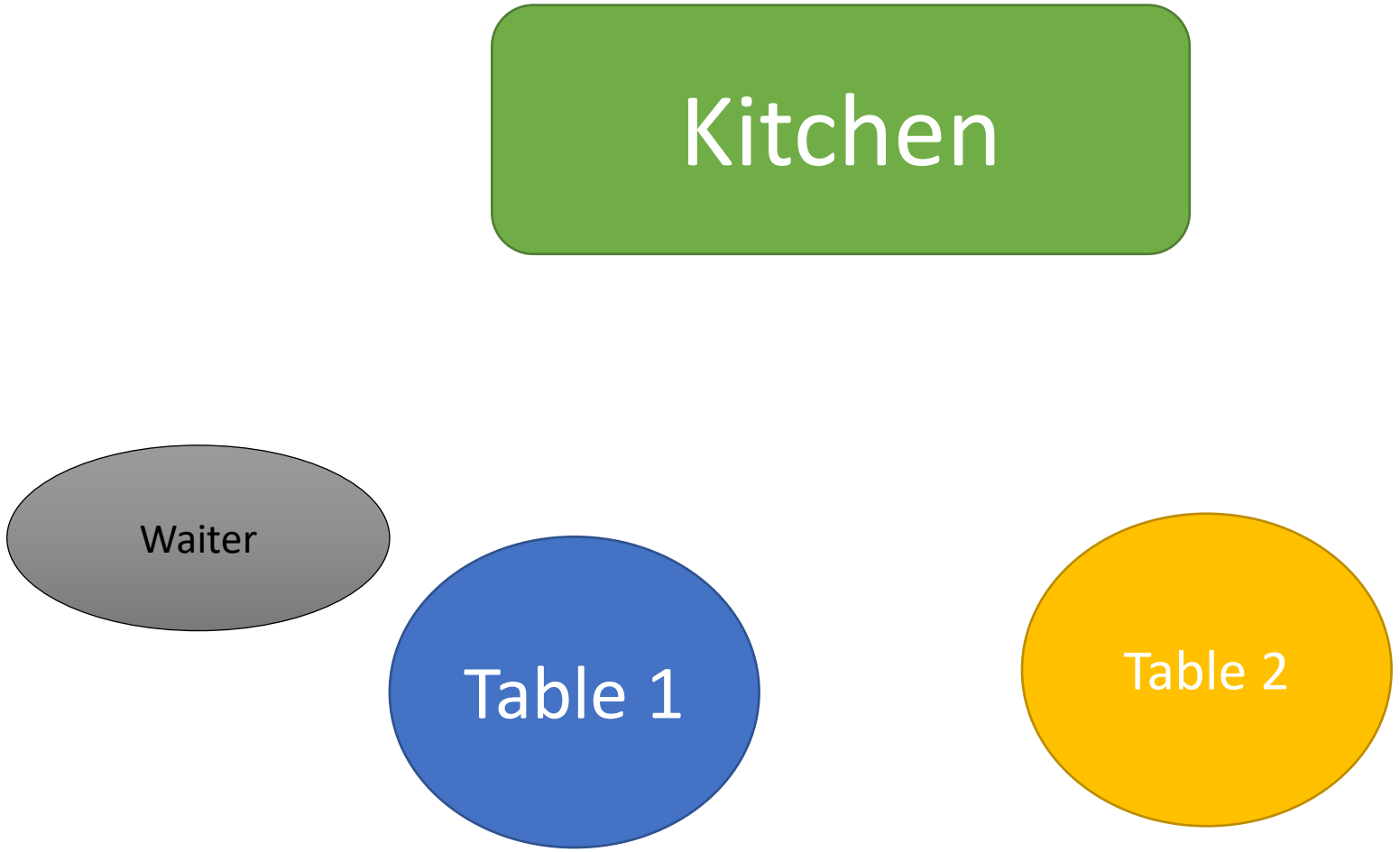
- **Node.js is non blocking!**
- Here is how PHP or ASP handles a file request:
  1. Sends the task to the computer's file system.
  2. Waits while the file system opens and reads the file.
  3. Returns the content to the client.
  4. Ready to handle the next request.
- Here is how Node.js handles a file request:
  1. Sends the task to the computer's file system.
  2. Ready to handle the next request.
  3. When the file system has opened and read the file, the server returns the content to the client.
- Node.js eliminates the waiting, and simply continues with the next request.
- Node.js runs single-threaded, non-blocking, asynchronously programming, which is very memory efficient.

JS is
asynchronous
single threaded
nonblocking

The restaurant analogy!

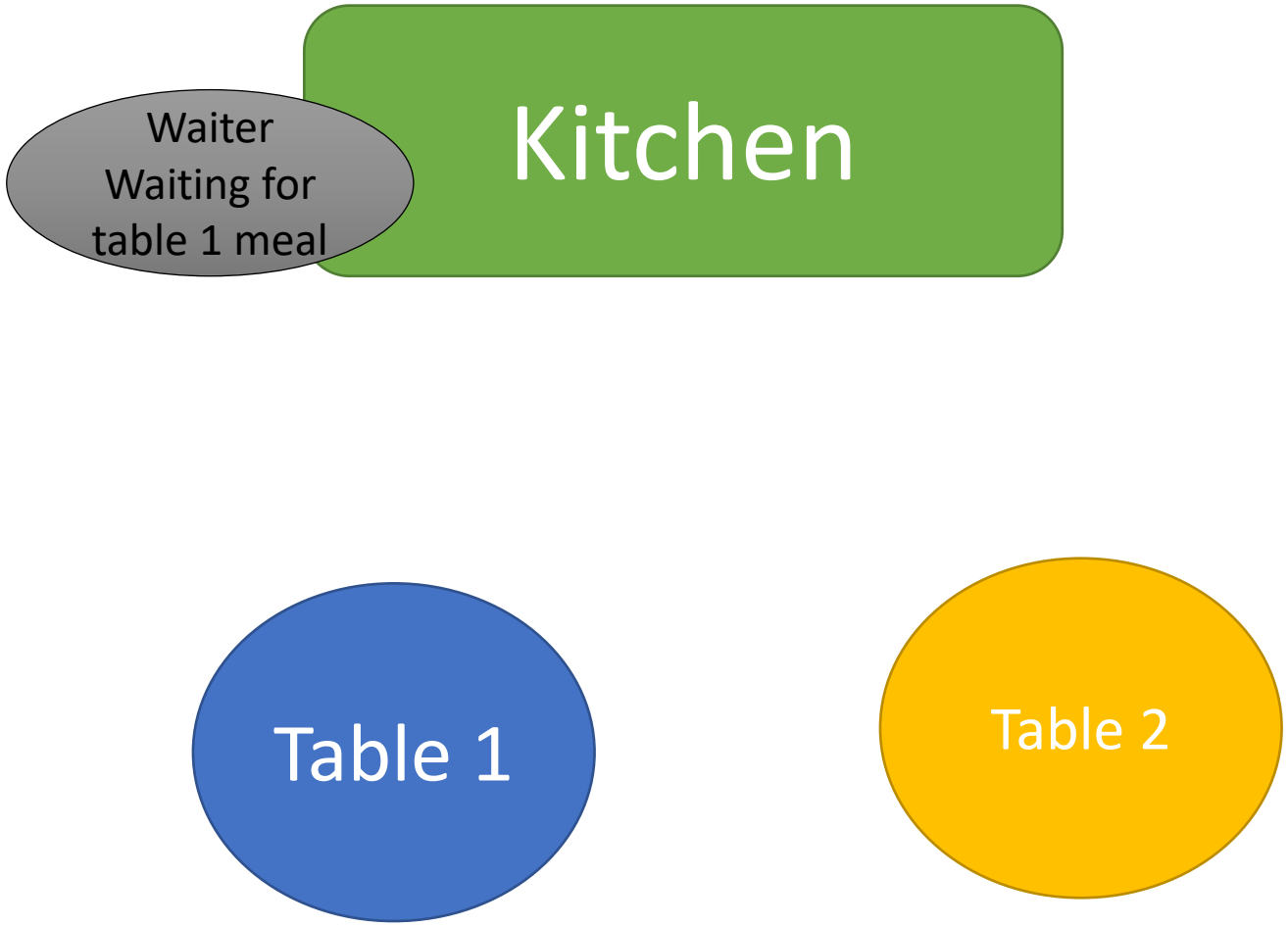
Example 1

- Same waiter can serve multiple tables



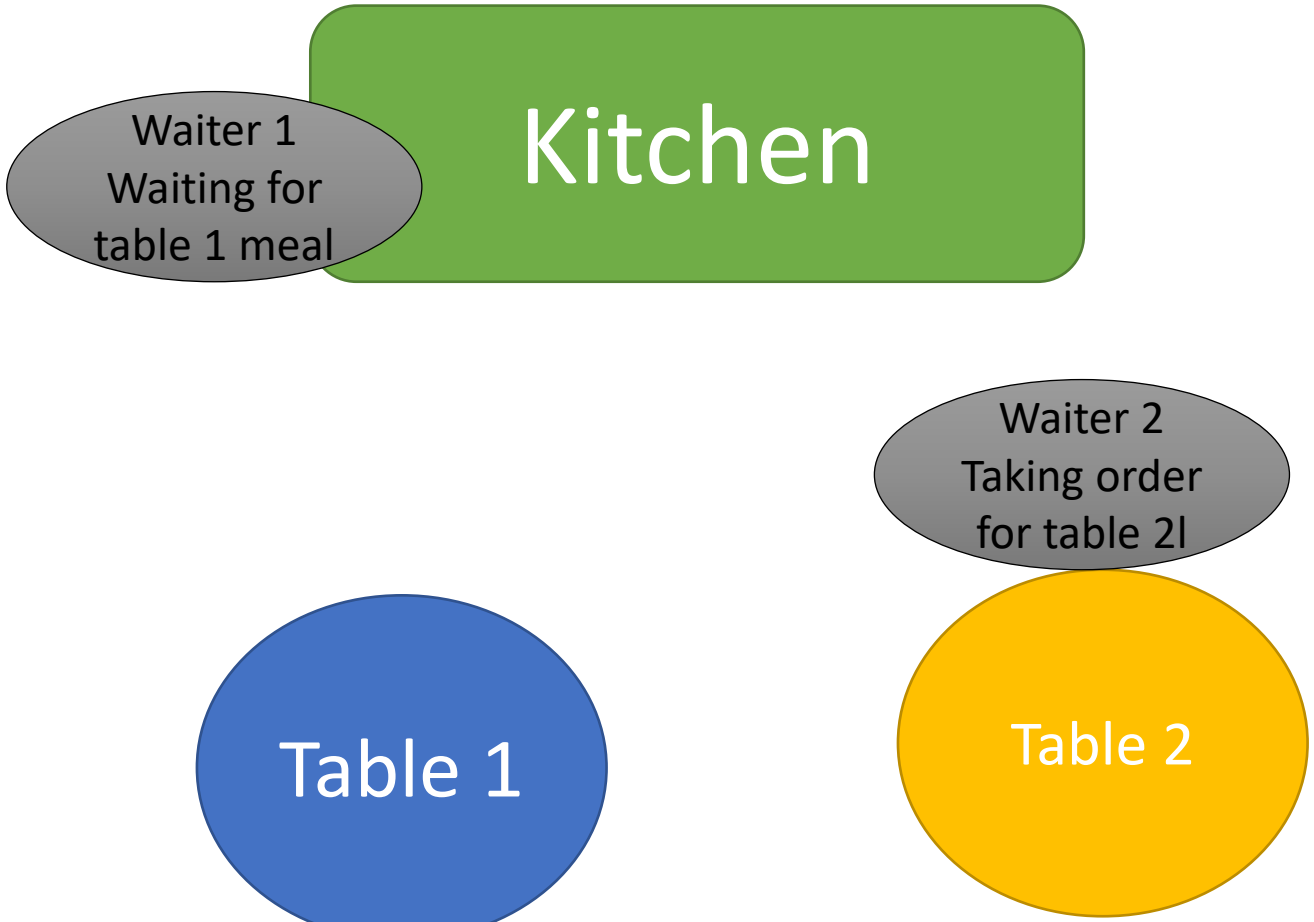
Example 2

- Same waiter can serve multiple tables, but every time waits for the chief to prepare the meal then (and only then) takes another order.



Example 3

- Multiple waiters
- Each dedicated to a single table only!

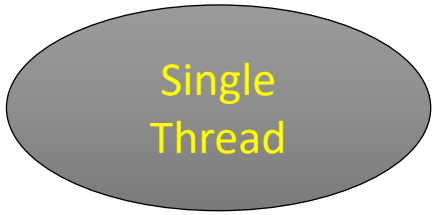


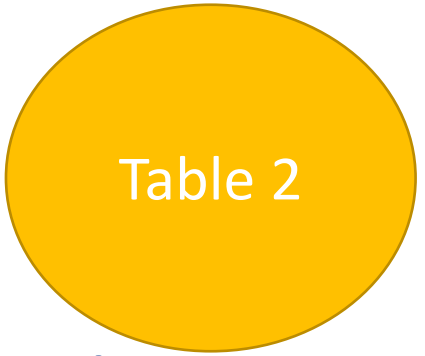
- Example 1: single threaded non-blocking (asynchronous)
- Example 2: single threaded blocking (synchronous)
- Example 3: multi-threaded

JavaScript(nodejs) is
Single threaded
Asynchronous(non blocking) just like the restaurant in
Example 1 (one waiter serves everyone)

Non-blocking

- Same waiter can server multiple tables (don’t not get blocked by one table)

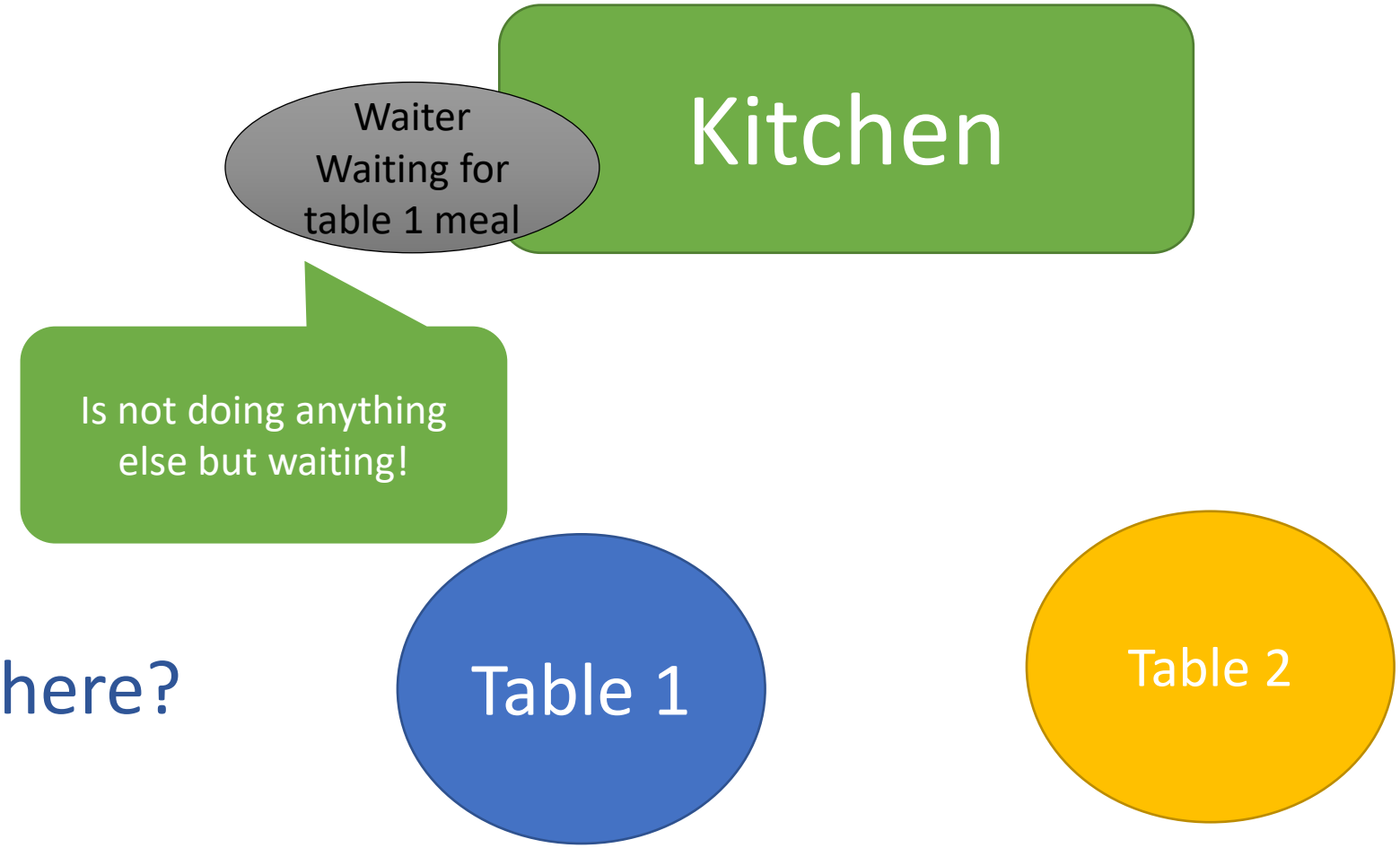




JavaScript(nodejs) is single threaded Asynchronous(non blocking) architecture
Example 1

Blocking or synchronous (ASP. Net by nature)

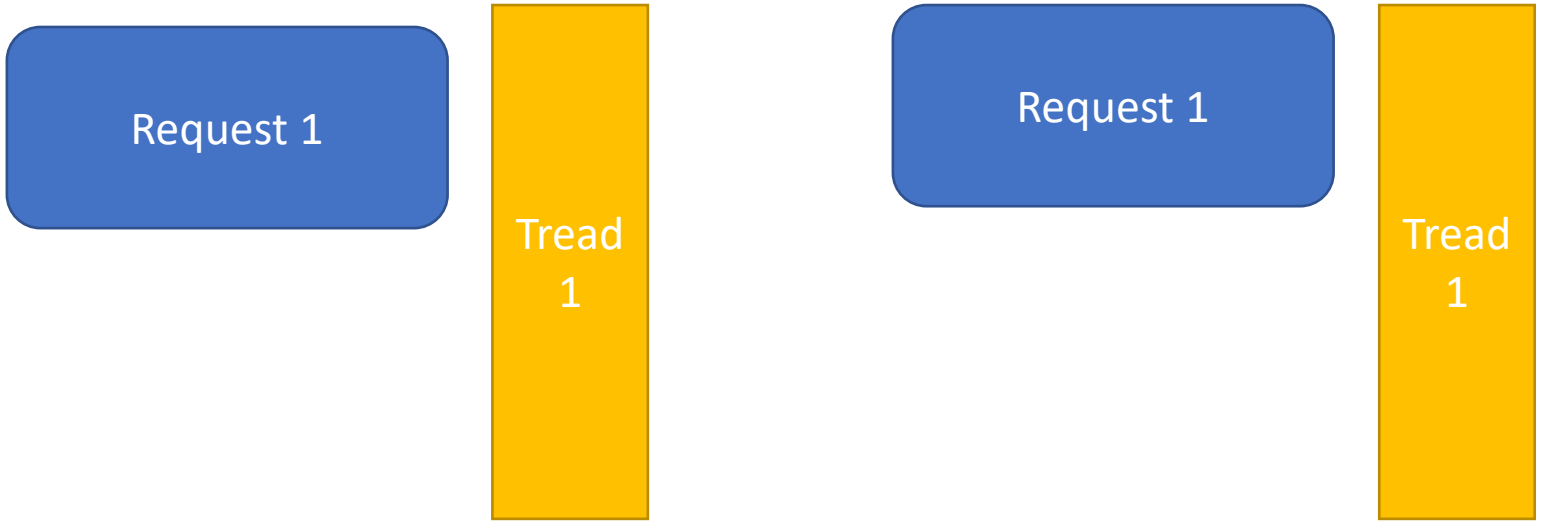
- Same waiter can server multiple tables, but every time waits for chief to prepare the meal then takes another order.



Q:What's the problem here?

We are not utilizing our resources (the waiter) efficiently

What if there are multiple requests for synchronous systems?



Imaging 100 concurrent requests for a synchronous system.

Then the system has to create 100 threads! (100 waiters!!)

Check this good reference: https://youtu.be/6oP-c30s7co?t=6m8s

Lets get started with

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node.js

Installation
and
Example code

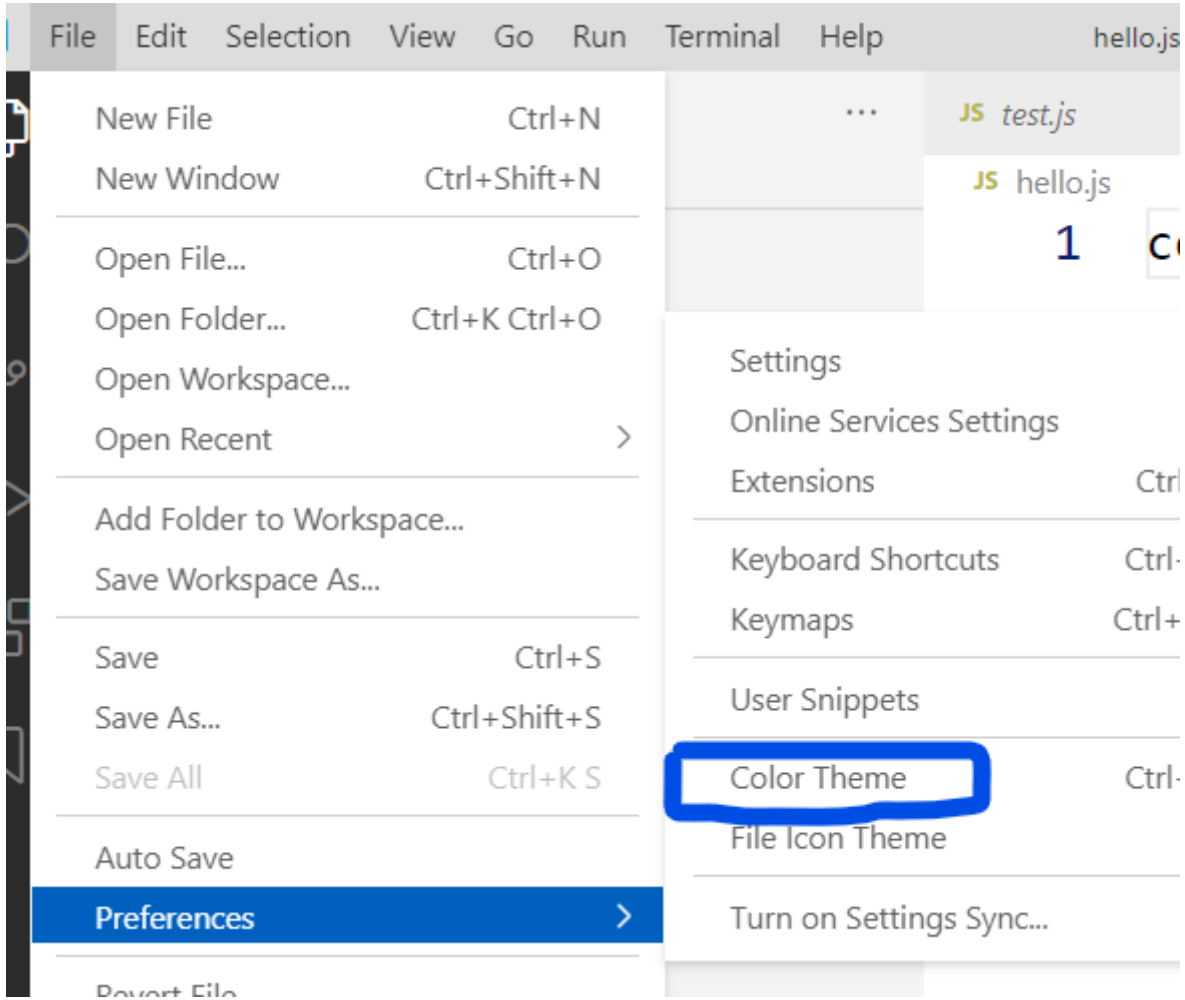
Getting started

- Follow the instructions at …
- …**NodeJs-Install-and-Debug.pdf**
- To install nodejs on your machine locally and to use Visual Studio Code to debug
- Using Nodejs you can easily develop a web server at your pc
- Then you send requests from your browser or the html files stored in your machine to the nodejs server you have developed

Example 1 : Hello world!

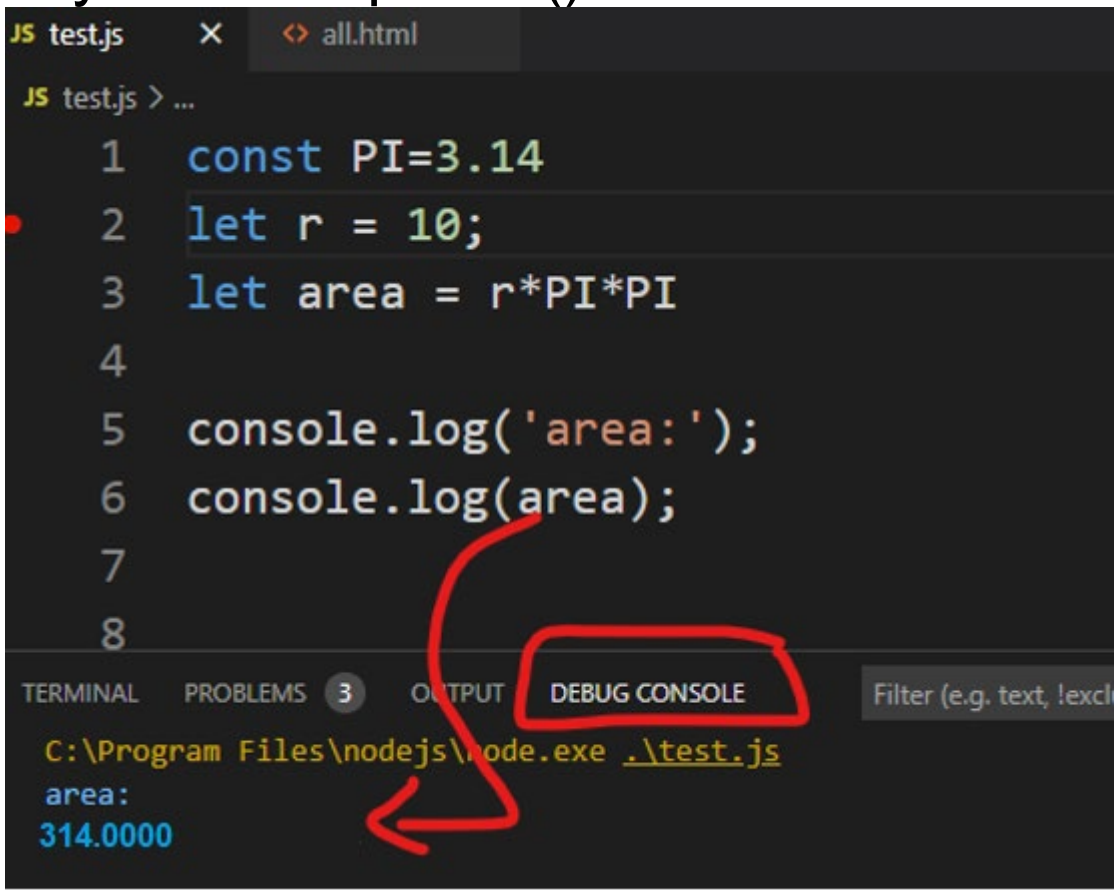
- Just like any desktop programing language. Here console.log acts like System.out.println() in Java

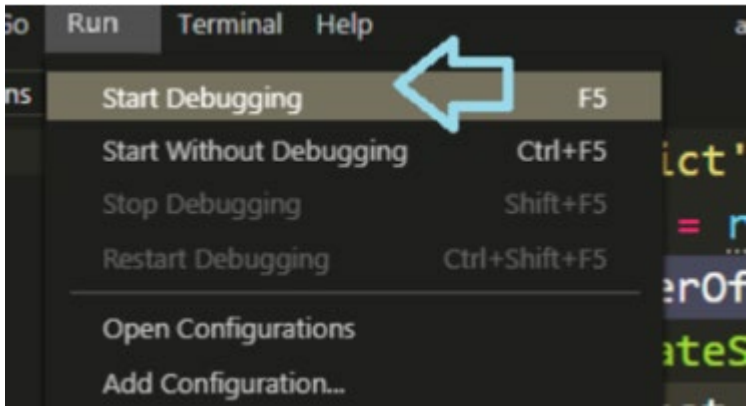
You can change the look and feel of your VSC (Visual Studio Code)



Example 2 : area calculation

- Just like any desktop programing language. Here console.log acts like System.out.println() in Java





Follow the steps on "…-NodeJs-Install-and-Debug.pdf" to learn how to debug your server side nodejs code in VSC

- Note the break point on the line 2
- Bad function identifier/name ! Do we really calculate the area of circle like this? Or is it just circumference

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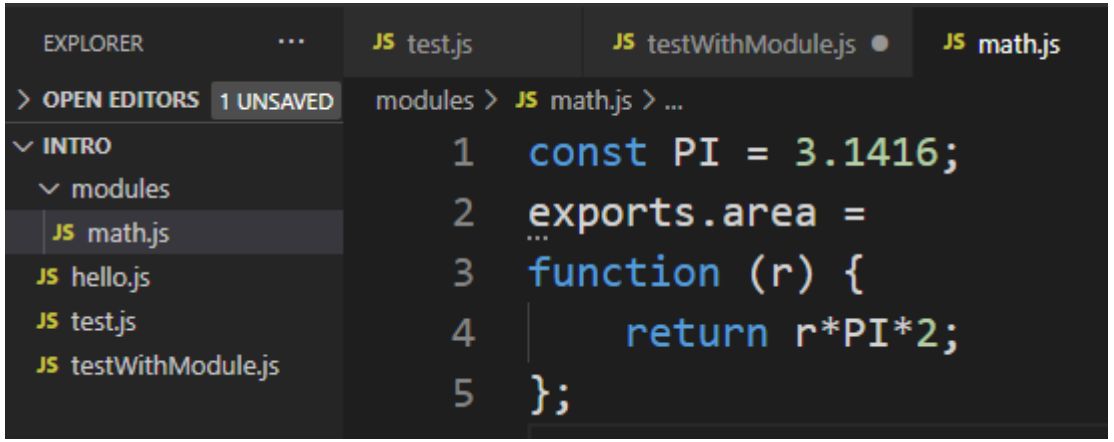
Put your functions
in
Modules

What is a Module in Node.js?

- Consider modules to be the same as JavaScript libraries.
- A set of functions you want to include in your application.

Example 3, area calculation, using module

- 1. Our module math.js is located at modules/math.js
- Notice that we use ./ to locate the folder of our module
- That means that the folder is located in the same folder as the main Node.js file.
- 2. Notice we don't need to include the .js when we import the module (its optional)



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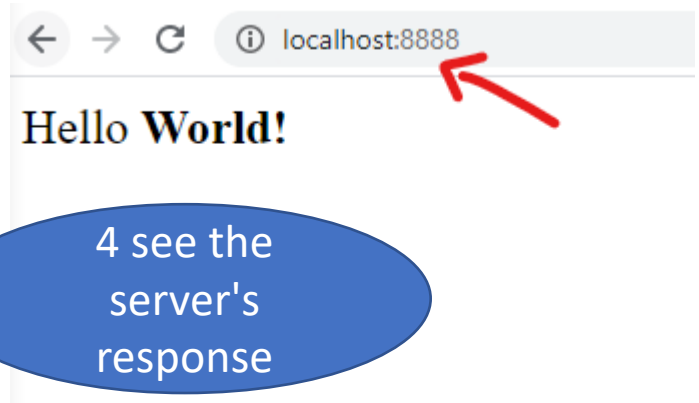
More examples using nodejs **built-in modules**

Example 4 : a simple http server

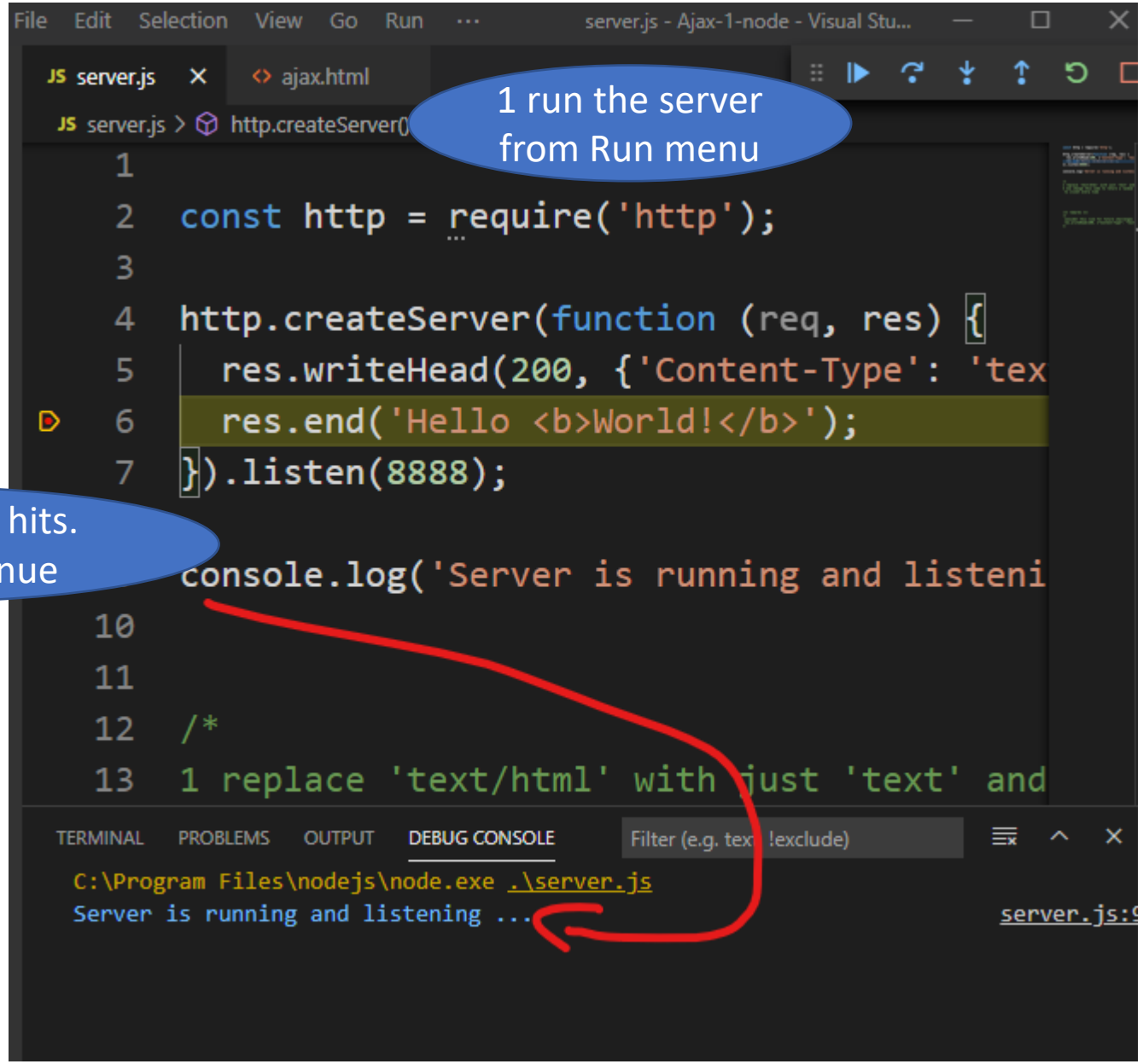
- We are using the nodejs build-in module 'http'
- The server receives a request from

the client (the browse

2 enter the url



4 see the server's response



3 the breakpoint hits. Press > to continue

Example 4 : a simple http server …

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

http.createServer(function (req, res) {
  console.log("The server recived a request ");
  res.writeHead(200, { "Content-Type": "text/html", "Access-Control-Allow-Origin": "*" });
  res.end('Hello <b>World!</b>');
}).listen(8888);
```

- 1 at your local browser type http://localhost:8888/ and observe the result
- 2 replace 'text/html' with just 'text' and see what happens
- 3 now change this code to return a random number between 0 to 10
- to clinet every time
- 4 what does "Access-Control-Allow-Origin" do? do we need it now?

Example 4, returning server's current date (put functions in module)

myModule.js

```
exports.area =
function () {
    return Date();
};
```

compare

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

let dt = require('./myModule');

http.createServer(function (req, res) {
   res.writeHead(200, {'Content-Type': 'text/html'});
   res.write("Now: " + dt.myDateTime());
   res.end();
}).listen(8888);
```

In-class activity

- Replace the 'text/html' with just 'text' and observe the response that the client receives

server.js × ajax.html

JS server.js > ...

```
1
2  const http = require('http');
3
4  http.createServer(function (req, res) {
5    console.log("Hi");
6    res.writeHead(200, {'Content-Type': 'text/html'});
7    res.end('Hello <b>World!</b>');
8  }).listen(8888);
9
10 console.log('Server is running and listening ...');
11
12
```

Example 5, using 'url' built-in module to extract the query strings in the url

Using url built-in module to pars parameters in a string

```
let url = require('url');
let adr =
'http://localhost:8888/default.htm?name=John&age=23';
let q = url.parse(adr, true);

console.log(q.host); //returns 'localhost:8888'
console.log(q.pathname); //returns '/default.htm'
console.log(q.search); //returns '?name=John&age=23'

let qdata = q.query; //returns an object: { name: John,
age: 23 }
console.log(qdata.name); //returns 'John'
```

Example 5: http server with parameters

server.js

```
let http = require('http');
let url = require('url');
http.createServer(function (req, res) {
  let q = url.parse(req.url, true);
  console.log(q.query); //returns the object form of '?name=John'
  res.writeHead(200, {"Content-Type": "text/html"});
  res.end('Hello '+q.query["name"]);
}).listen(8888);

// at your browser address bar, try
//http://localhost:8888/?name=John
```

```
C:\Program Files\nodejs\node.exe .\server.js
{name: 'John'}
```

- Note! I did not need `"Access-Control-Allow-Origin": "*"`
- Why?

'fs', the file system built-in module

- We are going to be using another built-in module, 'fs', file system
- allows us to work with the file system on our computer or the server.
-

Example 6: Creating a file server in node js

- Create a Node.js file that opens the requested file and returns the content of the file to the client. If the file does not exists, throw a 404 error!

Example 6: Creating a file server in node js

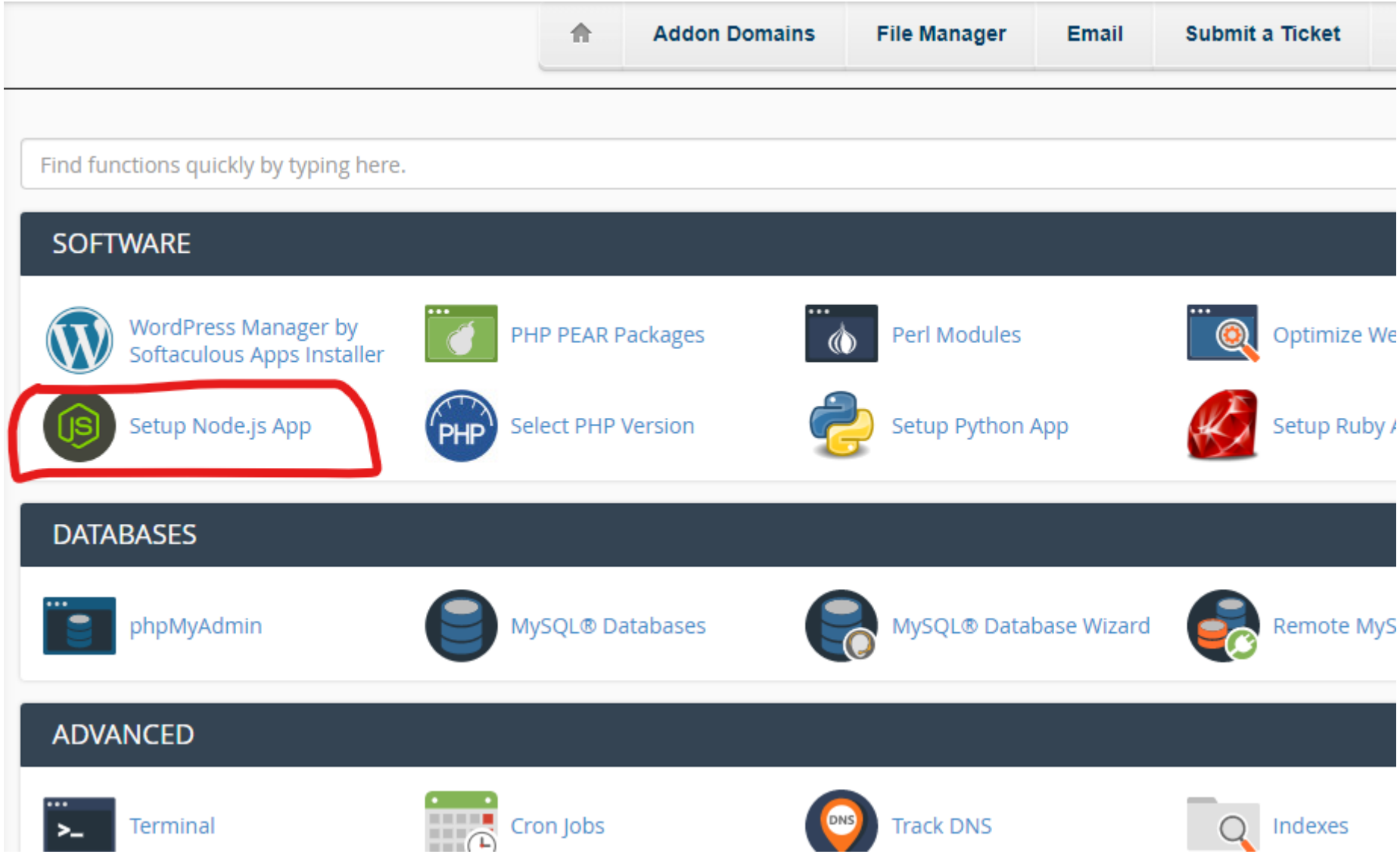
```
const http = require('http');
const url = require('url');
const fs = require('fs');
http.createServer(function (req, res) {
    const q = url.parse(req.url, true);
    const filename = "." + q.pathname;
    fs.readFile(filename, function (err, data) {
        if (err) {
            res.writeHead(404, { 'Content-Type': 'text/html' });
            return res.end(q.pathname + " 404 Not Found!");
        }
        res.writeHead(200, { 'Content-Type': 'text/html' });
        res.write(data);
        return res.end();
    });
}).listen(8888);
// at your browser address bar, try
//http://localhost:8888/file.txt
```

4xx are status message codes meaning client error.
That means client request was not valid, either due to authentication or the client asked for a file which did not exist
404: not found

HTTP Status Messages:
https://www.w3schools.com/tags/ref_httpmessages.asp

Setting up node js app on shared hosting with cPanel

- Refer to the lecture videos



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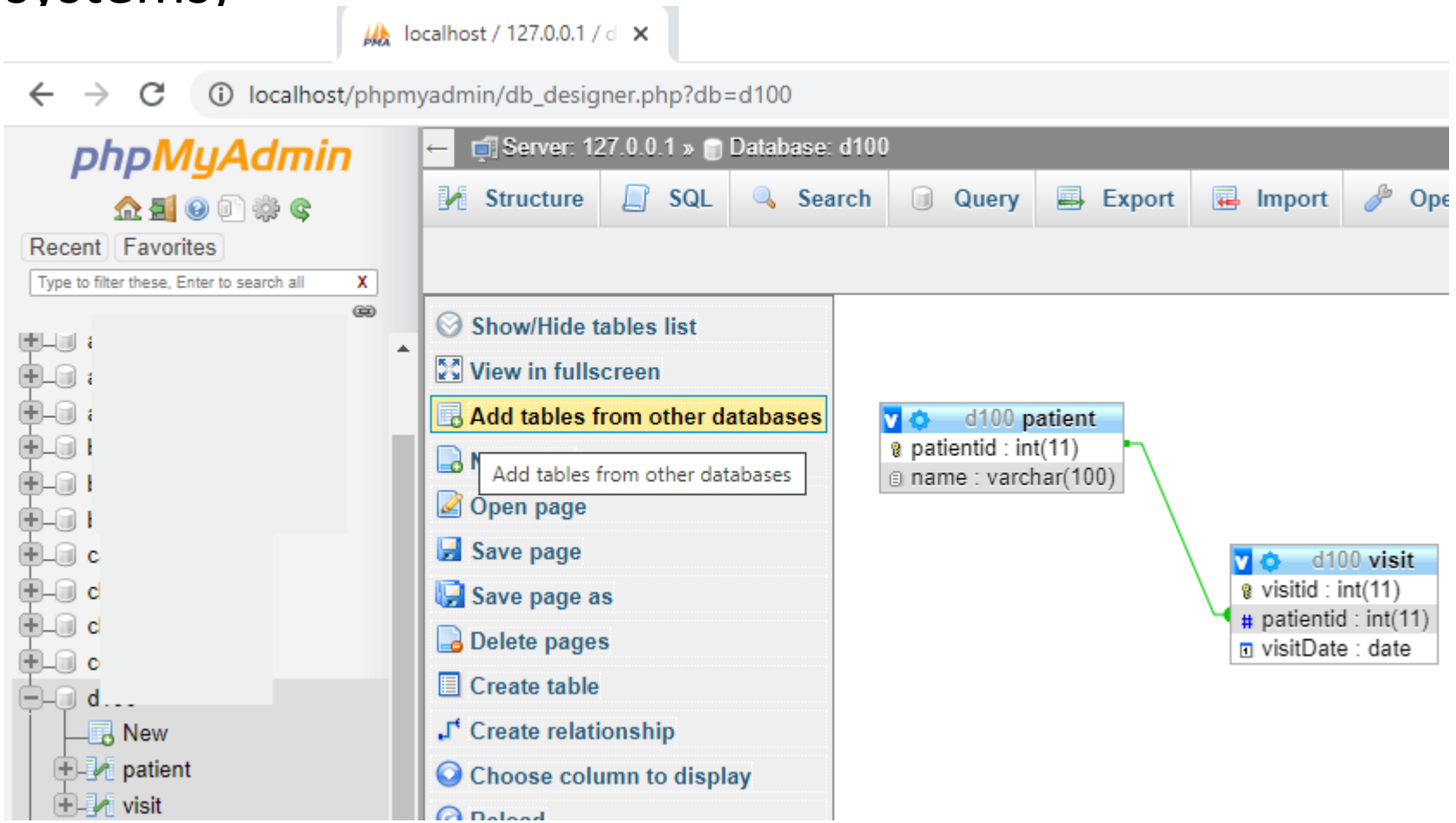
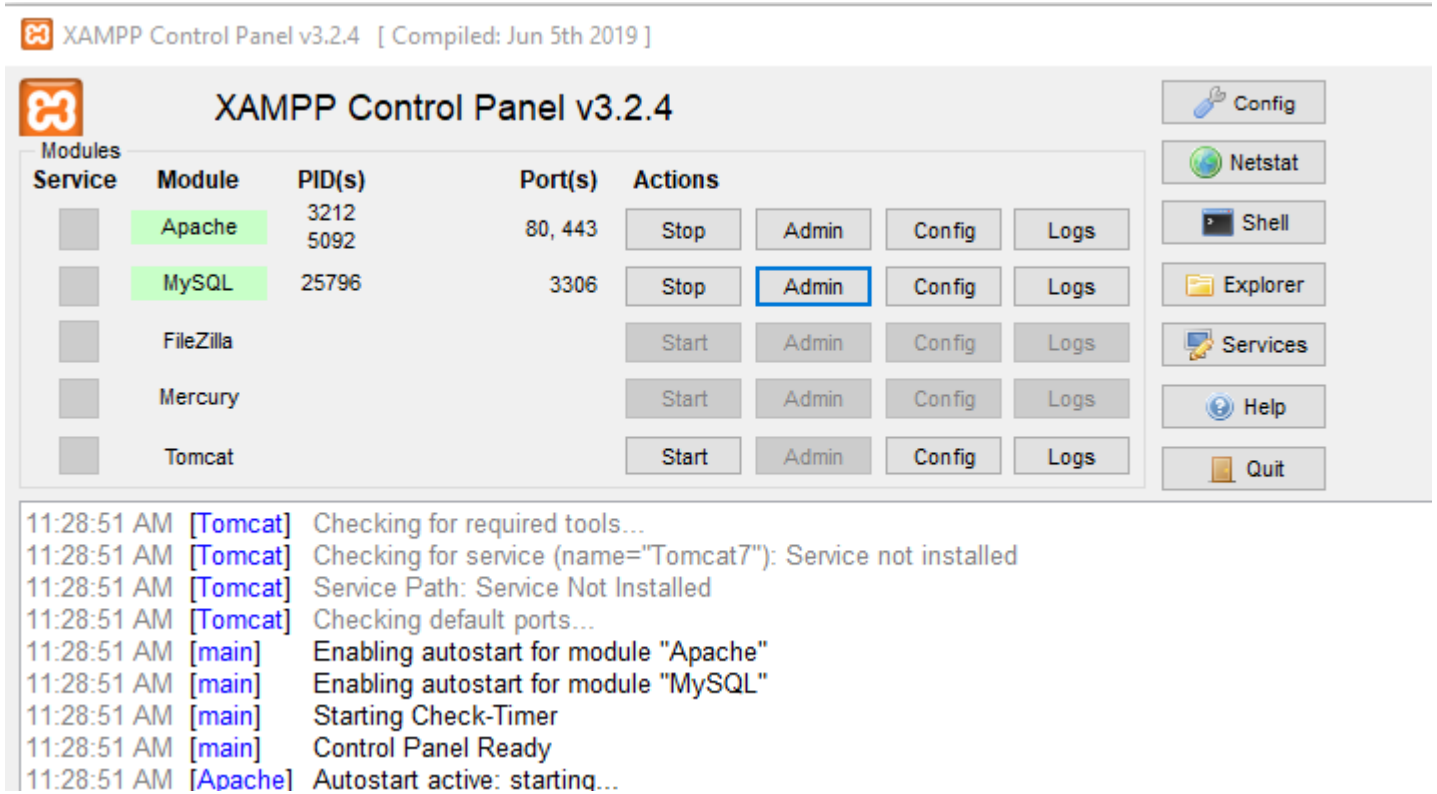
Tips for future

Database server we use in this course

- We will use the free and open source relational DB administration tool
- Called phpMyAdmin which is browser based (thus working on all operating systems)



- You will learn how to use XAMPP to install phpMyAdmin on your machine
- (in two weeks)



ESC6 tips of the week/ Arrow functions to replace old ones

- regular functions

```
setTimeout(function() {

}, timeout);
```

- arrow functions

```
setTimeout(() => {

}, timeout);
```

```
date = function() {
  return new Date();
}
```

```
date = () => {
  return new Date();
}
```

```
// one parameter
hello = (val) => "Hello " + val;

hello = val => "Hello " + val;

// two or more parameters
sum = (a,b) => a+b;
```

Resources

- https://www.w3schools.com/nodejs/nodejs_intro.asp
- https://en.wikipedia.org/wiki/Node.js
- On JS being asynchronous: https://youtu.be/6oP-c30s7co?t=6m8s