Promise, Async & Await

Maharishi International University - Fairfield, IA

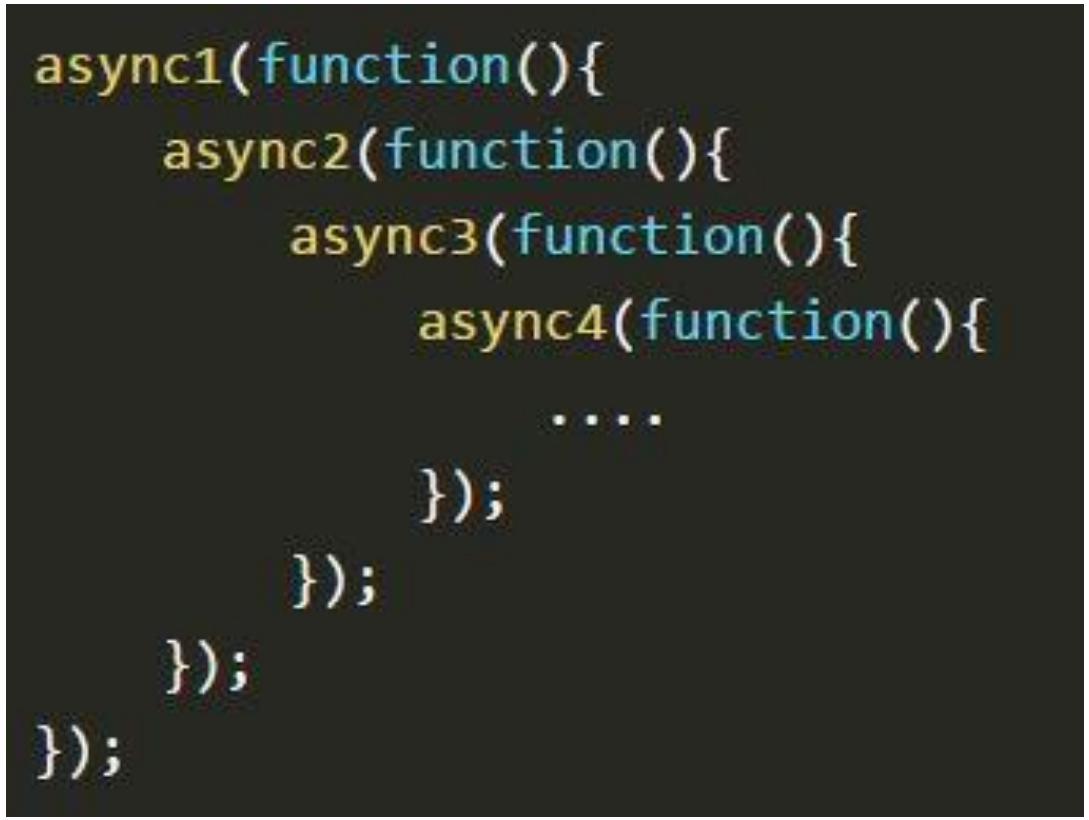
- All rights reserved. No part of this slide presentation may be reproduced or utilized in any form or by any means, electronic or mechanical, including

  photocopying or recording, or by any information

  storage and retrieval system, without permission in writing from Maharishi International University.

The Boomerang Effect (Callback Hell)

As you may have noticed, asynchronous programming relies on callback functions that are usually passed as arguments.
This can turn your code into "**callback spaghetti**", making it visually hard to track which context you are in. This style also makes debugging your application difficult, reducing even more the maintainability of your code.



Asynchronous Code

To write a nice asynchronous code away from the callback hell we can use one of these code structures:

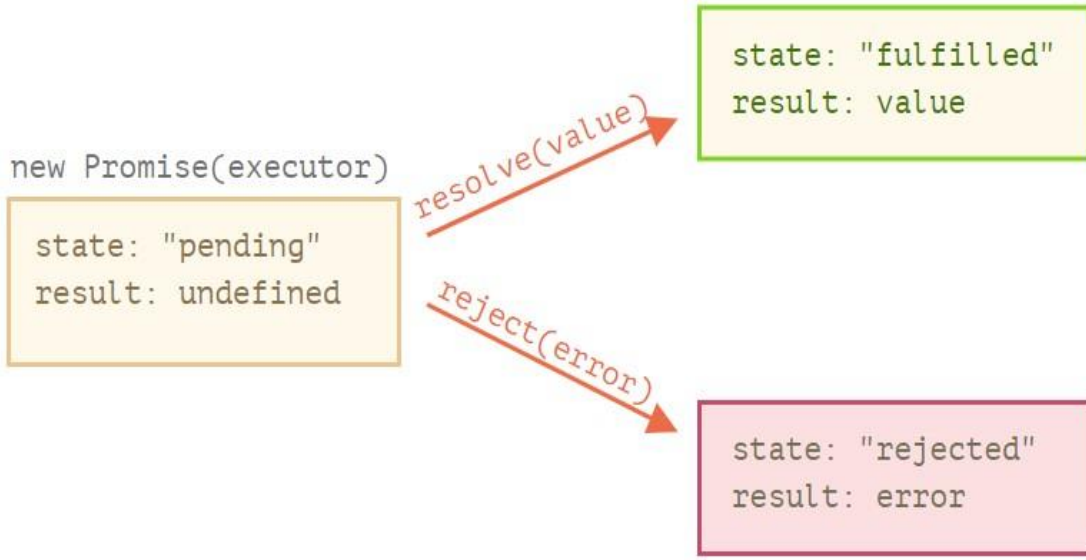
- **Promises (ES6)**
- Function Generators (ES6)
- **Async & Await (ES7, Node 8)**
- util.promisify (Node 8)
- Observables (ES7)

Introduction

- JavaScript executes code in a single thread, which brings a risk of blocking the thread if a single line takes long time to process. This means until that line finishes, the next line of code won't be processed.
- For example, handling of AJAX request should be done on a different thread, otherwise our main thread would be blocked until the network response is received.

The Promise Object

The **`Promise`** object is used for asynchronous c
represents a value which may be available now, c




```
new Promise( function(resolve, reject) { ... } );
```

A Promise has one of these states:

- **pending**: initial state, not fulfilled or rejected.
- **fulfilled**: meaning that the operation completed successfully.
- **rejected**: meaning that the operation failed.

A pending promise can either be fulfilled with a value, or rejected with a reason (error).

Create a Promise Object

```
var giveMePizza = function(){
        return new Promise(function(resolve,reject){
                if(false){
                        resolve("This is true"); // then() will be called
                } else {
                        reject("This is false"); // catch() will be called
                }
        })
}
giveMePizza()
        .then(data => console.log(data))
        .catch(err => console.error(err));
console.log('I will run immediately after calling giveMePizza() and before any
result arrives');
```

The callback from the `Promise` constructor gives us two parameters, `resolve` and `reject` functions, that will affect the state of the `Promise` object. If everything works, call `resolve`, otherwise call `reject`. Note that you can pass in values to `resolve` and `reject` which will be further passed on to the respective handlers, `then` and `catch`.

Create a Promise Object (cont.)

```
let promise = new Promise(function(resolve, reject) {
    // the function is executed automatically when the promise is constructed
    // after 1 second signal that the job is done with the result "done".
    setTimeout(() => resolve("done"), 1000);
});
```


```
let promise = new Promise(function (resolve, reject) {
// after 1 second signal that the job is finished with an error
    setTimeout(() => reject(new Error("Whoops!")), 1000);
});
```

How Do Promises work?

The biggest misconception about Promises in JavaScript is that they are asynchronous, but not everything of Promises is asynchronous.

Only the parts of **`resolve`** and **`reject`** are going to be asynchronous.

```
const promise = new Promise((resolve, reject) => {
    console.log(`Promise starts`)
    resolve(`Promise result`)
    console.log(`Promise ends`)
})

console.log(`Code starts`)
promise.then(console.log)
console.log(`Code ends`)
```

Example

```
const promise = new Promise((resolve, reject) => {
    setTimeout(() => { resolve('Promise results') }, 1000); // resolve after 1 second
});

console.log('Code starts');
promise.then(console.log)
console.log('I love JS');
```

What happens when we change the timer to 0

Consumers: then, catch, finally

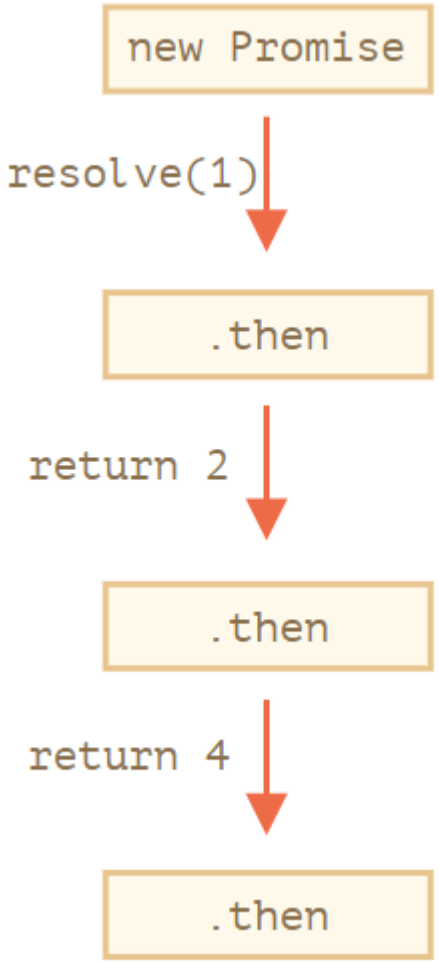
- A Promise object serves as a link between the executor and the consuming functions, which will receive the result or error. Consuming functions can be registered (subscribed) using methods .then, .catch and .finally.

```
let promise = new Promise(function (resolve, reject) {
    const random = Math.random();
    console.log(' random: ', random);
    if (random > 0.5)
        setTimeout(() => resolve("done"), 1000);
    else
        setTimeout(() => reject(new Error("Woops!")), 1000)
});

promise.then(result => console.log(result))
    .catch(error => console.log(error))
    .finally(() => console.log('Promise ready!'));
```

Promises chaining

```
new Promise(function(resolve, reject) {
    setTimeout(() => resolve(1), 1000); // (*)
}).then(function(result) { // (**)
    alert(result); // 1
    return result * 2;
}).then(function(result) { // (***)
    alert(result); // 2
    return result * 2;
}).then(function(result) {
    alert(result); // 4
    return result * 2;
});
```



Async /await

- It’s a special syntax to work with promises in a more comfortable fashion
- The `async` keyword: when you put `async` keyword in front of a function declaration, it turns the function into an `async` function.
- The `await` keyword: `await` only works inside `async` functions. `await` can be put in front of any `async` promise-based function to pause your code on that line until the `promise` fulfills, then return the resulting `value`.

Async functions

- async can be placed before a function. An async function always returns a promise:
  - When no return statement defined, or return without a value. It turns a resolving a promise equivalent to return Promise.Resolve()
  - When a return statement is defined with a value, it will return a resolving promise with the given return value, equivalent to return Promise.Resolve(value)
  - When an error is thrown, a rejected promised will be returned with the thrown error, equivalent to return Promise.Reject(error)

```
console.log('start');
async function f() {
    return 1;
}
f().then(console.log);
console.log('end');
```

Await

- The keyword `await` makes JavaScript wait until that `promise` settles and returns its result.
- `await` literally suspends the function execution until the `promise` settles, and then resumes it with the `promise` result. That doesn't cost any CPU resources, because the JavaScript engine can do other jobs in the meantime: execute other scripts, handle events, etc.
- It's just a more elegant syntax of getting the `promise` result than `promise.then`.

```
console.log('start');
async function foo() {
    return ' done ! ';
}
async function bar() {
    console.log(' insidebar - start');
    let result = await foo();
    console.log(result);
    console.log('insidebar - end');

}
bar();

console.log('end');
```

Await (cont.)

1. Can't use `await` in regular functions. If we try to use `await` in a non-async function, there would be a syntax error:

```
async function foo() {
    return 'done!';
}

function bar() {
    let result = await foo(); // Syntax error
    console.log(result);
}
bar();
```

2. `await` won't work in the top-level code

```
// syntax error in top-level code
async function baz() {
    return 'baz...';
}

let result = await baz(); //Syntax Error
console.log(result);
```

Error Handling in Async functions

1. Use `await` inside async function
2. Chain async function call with a `.catch()` call.

```
async function thisThrows() {
    throw new Error("Thrown from thisThrows()");
}

async function run() {
    try {
        await thisThrows();
    } catch (e) {
        console.log('Caught the error....');
        console.error(e);
    } finally {
        console.log('We do cleanup here');
    }
}

run();
```

```
async function thisThrows() {
    throw new Error("Thrown from thisThrows()");
}

thisThrows()
    .catch(console.error)
    .finally(() => console.log('We do cleanup here'));
```

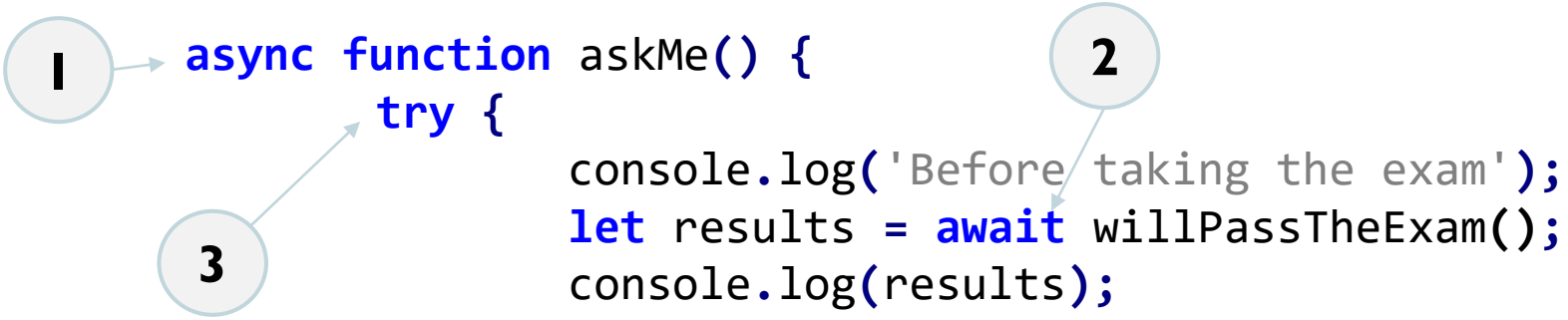
Example - Promise

```
var Studied = true;
var willPassTheExam = function(){
        return new Promise(function(resolve, reject) {
                if (true) resolve('Pass');
                else reject(new Error('Fail'));
        })
};

var askMe = function () {
        willPassTheExam()
                .then(function(results){ console.log(results); })
                .catch(function (error) { console.log(error); });
};

askMe();
console.log('Finish')
```

Example – Async & Await




```
async function askMe() {
        try {
                console.log('Before taking the exam');
                let results = await willPassTheExam();
                console.log(results);
                console.log('After taking the exam');
        } catch (error) {
                console.log(error);
        }
}

askMe();
console.log('Finish')
```

Fetch API

- The Fetch API provides a JavaScript interface for accessing and manipulating parts of the HTTP pipeline, such as requests and responses. It also provides a **global** fetch() method that provides an easy, logical way to fetch resources **asynchronously** across the network.
- This kind of functionality was previously achieved using XMLHttpRequest.
- Syntax:

  let promise = fetch(url, [options]);

  - url – the URL to access.
  - options – optional parameters: method, headers etc.
  - Without options, this is a simple GET request, downloading the contents of the url.

Using fetch() - GET

```
let promise = fetch('http://localhost:3000/products')
```

The browser starts the request right away and returns a promise that the calling code should use to get the result.

- Getting a response is usually a two-stage process.
  - First, the promise, returned by fetch, resolves with an object of the built-in Response class as soon as the server responds with headers.
    - `promise.then(response => console.log(response.ok, response.status));`
  - Second, to get the response body, we need to use an additional method call.
    - response.text() – read the response and return as text,
    - response.json() – parse the response as JSON,
    - …

```
promise.then(response => response.json())
       .then(result => console.log(result));
```

Using fetch() – POST with options

```
fetch('http://localhost:3000/products', {
        method: 'POST',
        body: JSON.stringify({
            title: 'cs472',
            description:'This is CS472 Lesson 14 Demo',
            price: 100,
        }),
        headers: {
            'Content-type': 'application/json; charset=UTF-8',
        },
    })
    .then((response) => response.json())
    .then((json) => console.log(json));
```

Using Async & Await

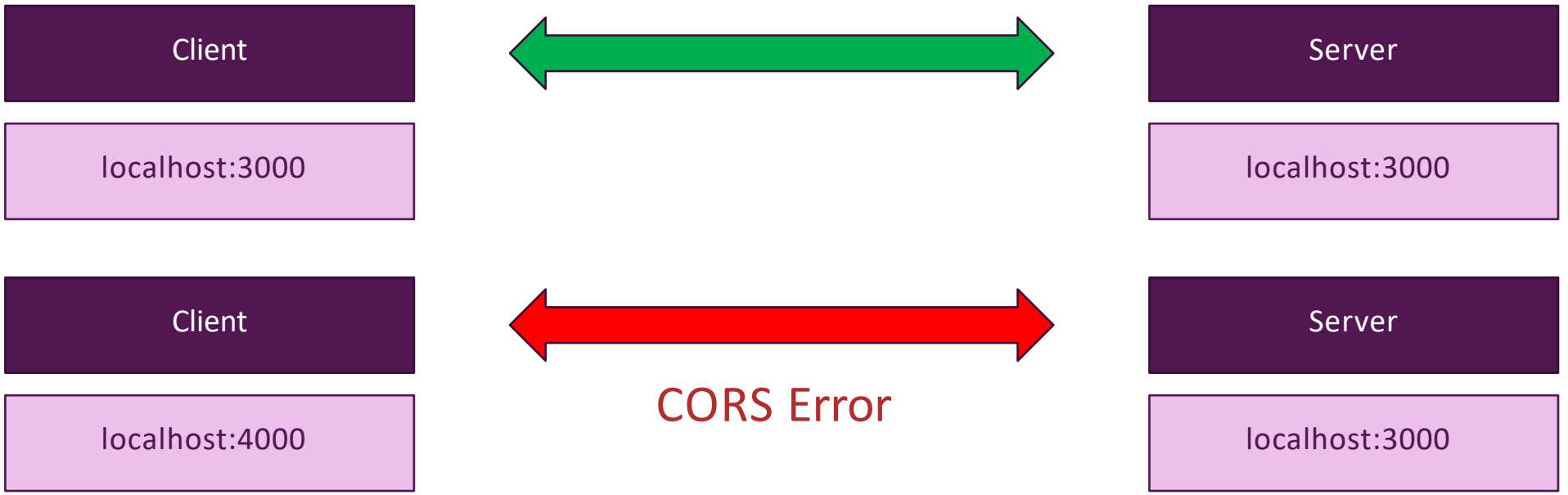
```
async function fetchProductById(id) {
    let response = await fetch("http://localhost:3000/products/"  + id);
    if (response.ok) {
        let json = await response.json();
        console.log(json);
    } else {
        console.log("HTTP-Error: " + response.status);
    }
}

fetchProductById(1);

// Remember to use try/catch in case of network problem
```

CORS (Cross-Origin Resource Sharing)

- **Cross-Origin Resource Sharing** (CORS) is a mechanism that uses additional HTTP headers to tell browsers to give a web application running at one origin, access to selected resources from a different origin. A web application executes a cross-origin HTTP request when it requests a resource that has a different origin (domain, protocol, or port) from its own.



cors

- npm install cors

- **Simple Usage (Enable *All* CORS Requests)**
  - `const cors = require('cors');`
  - `app.use(cors());`

- **Enable CORS for a Single Route**
  - `router.post('/users', cors(),userController.insert);`