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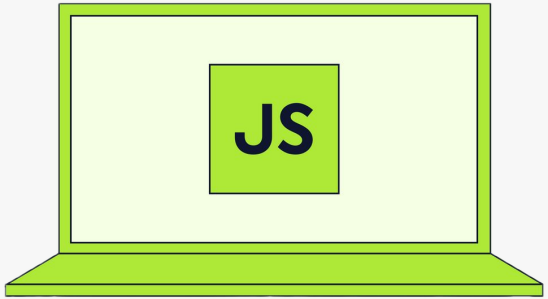
The Complete Javascript Course



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Lecture 10: Introduction to Promises

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JS

Table of Contents

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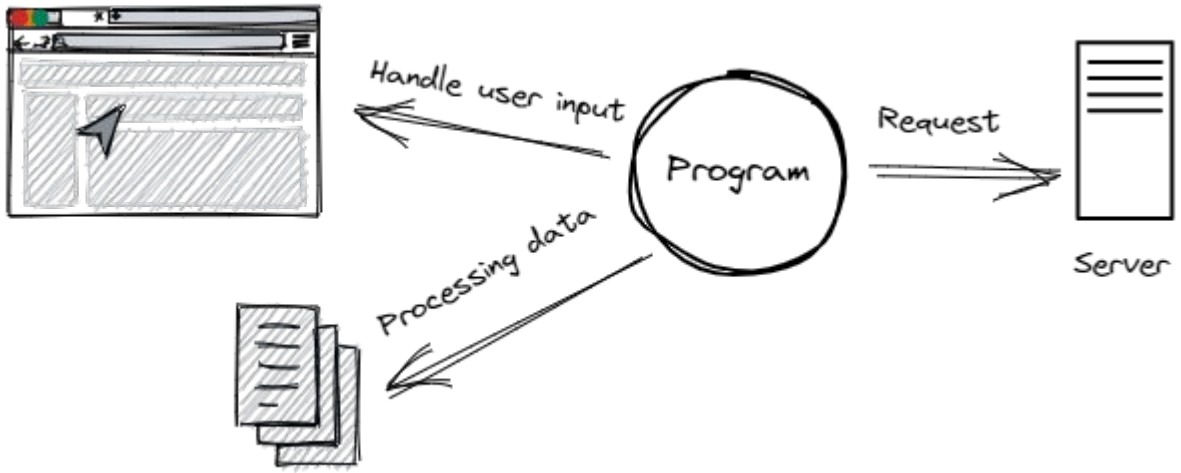
Why do we need Promises?

Pre-discussed: Async Programming

Asynchronous programming lets tasks run independently, allowing your program to continue other tasks while waiting for long operations to finish.



Here, the program sends a request to the server and, while waiting for the response, continues accepting and processing user inputs.

Pre-discussed: Ways to implement

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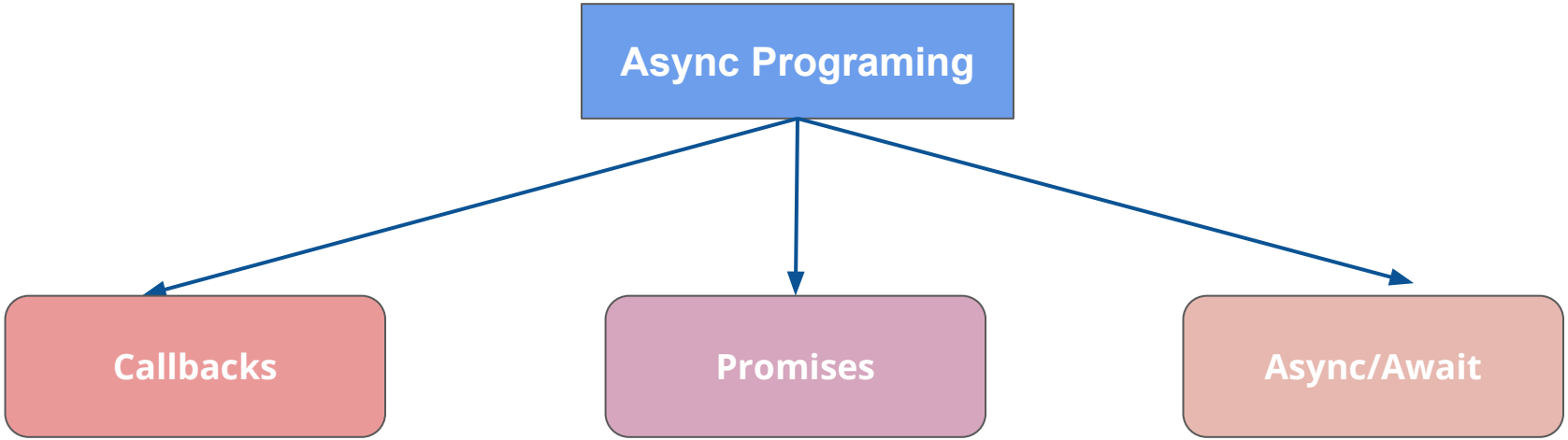
There are three main ways to implement asynchronous programming in JavaScript:



Pre-discussed: Callbacks

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In simple terms, a callback is just a function that you give to another function. The receiving function will then decide when and how to execute.

```
1  function task1(callback) {
2      console.log("Task 1 completed");
3      callback();
4      // Execute the callback after Task 1
5  }
6
7  function task2() {
8      console.log("Task 2 completed");
9  }
10
11 task1(task2);
12 // Passing task2 as a callback to task1
```

Here it is upto task1() function when and where it executes callback function. Here it is executing it immediately but that is not always the case.

Pre-discussed: Callbacks

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Let’s add a delay of 2000 milliseconds before callback executes using setTimeout().

```
function task1(callback) {
    setTimeout(() => {
      console.log("Task 1 completed");
      callback();
      // Execute the callback once Task 1 is done
    }, 2000); // Simulate a delay
}

function task2() {
    console.log("Task 2 completed");
}

task1(task2);
// Passing task2 as a callback to task1
```

Here we are adding a delay inside task1 function using setTimeout().

Callbacks: Don’t make function async

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Callbacks don’t make functions asynchronous!

```
1  function greet(name, callback) {
2      console.log("Hello, " + name);
3      callback();
4  }
5
6  function sayGoodbye() {
7      console.log("Goodbye!");
8  }
9
10 greet("Alice", sayGoodbye);
```

Output:
Hello, Alice
Goodbye!

Here, sayGoodbye() executes immediately after console.log(). There's nothing asynchronous happening.

Callbacks: Handle async operations

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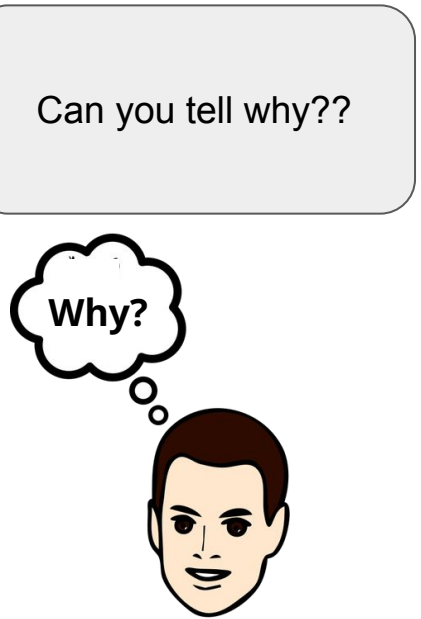
Let’s have a look at end to end comparison of performing async operations without and with callbacks.

```
1  function getUserData() {
2      fetch("https://jsonplaceholder.typicode.com/users/1")
3        .then(response => response.json());
4  }
5
6  let user = getUserData();
7  console.log(user);  // ❌ Output: undefined
```



Callbacks: Handle async operations

Here fetch() does return a value, but since we are not using callbacks, we can't add a task which only needs to happens after fetch operations completes.

```
1  function getUserData() {
2      fetch("https://jsonplaceholder.typicode.com/users/1")
3        .then(response => response.json());
4  }
5
6  let user = getUserData();
7  console.log(user);  // ❌ Output: undefined
```

We expect to get a value immediately after calling getUserData(), but since fetch() is asynchronous, the data isn't available yet, so we get undefined.

Callbacks: Handle async operations

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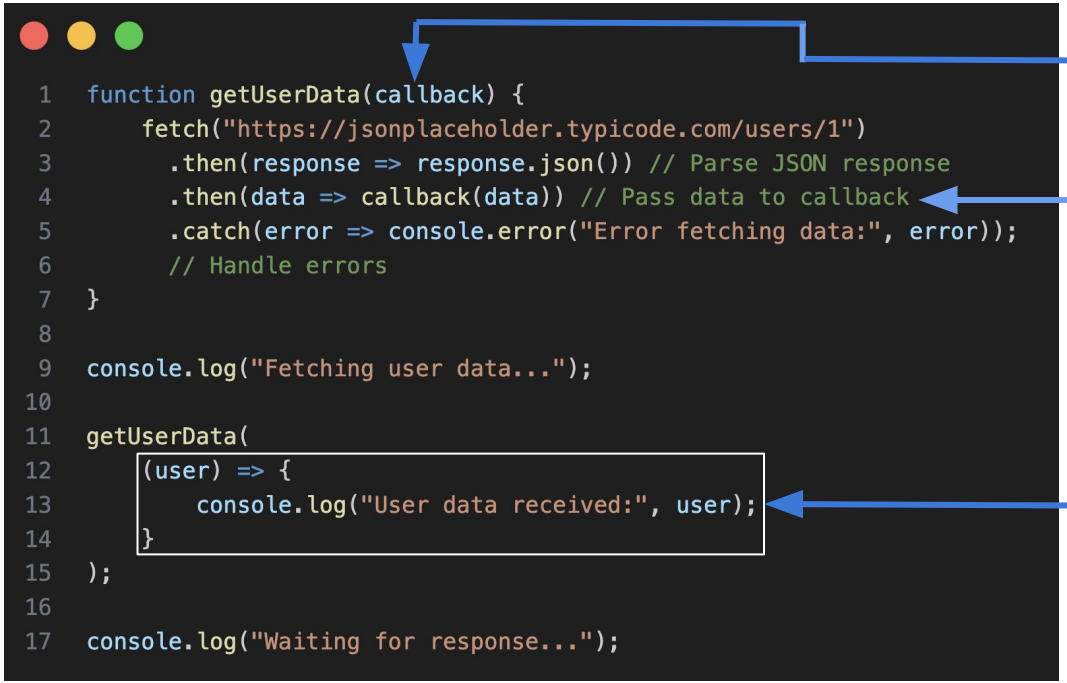
Instead we need to pass a function to which gets invoked only after fetch() completes its execution. And that function is called **Callback Function**.



```
function getUserData(callback) {
    fetch("https://jsonplaceholder.typicode.com/users/1")
      .then(response => response.json()) // Parse JSON response
      .then(data => callback(data)) // Pass data to callback
      .catch(error => console.error("Error fetching data:", error));
      // Handle errors
}

console.log("Fetching user data...");

getUserData(
    (user) => {
        console.log("User data received:", user);
    }
);

console.log("Waiting for response...");
```

Callback function got received

Callback function gets invoked only when fetch operation completes

Passing the callback function to getUserData() function

Challenge with Callbacks

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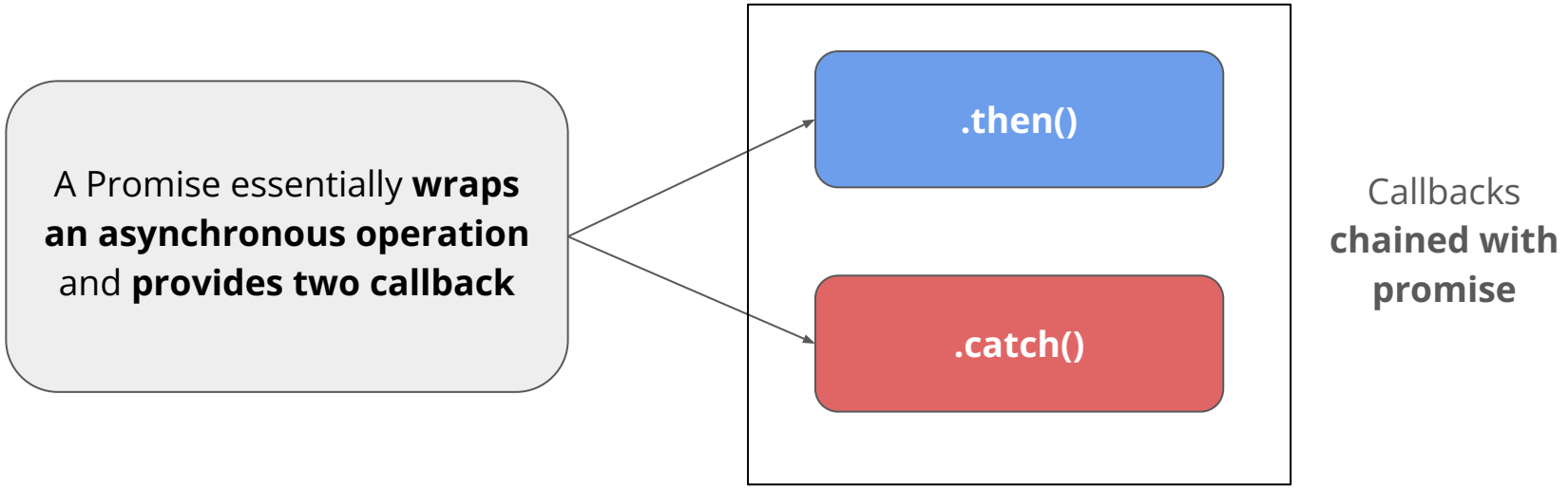
Callbacks facilitate asynchronous operations, but when multiple operations need to be performed sequentially, they can lead to callback hell.

```
3
4  a(function (resultsFromA) {
5      b(resultsFromA, function (resultsFromB) {
6          c(resultsFromB, function (resultsFromC) {
7              d(resultsFromC, function (resultsFromD) {
8                  e(resultsFromD, function (resultsFromE) {
9                      f(resultsFromE, function (resultsFromF) {
10                         console.log(resultsFromF);
11                     })
12                 })
13             })
14         })
15     })
16 });
17
```

Callback hell makes code hard to debug and update, leading to poor scalability.

Promises: a more structured way

Promises are built on callbacks, but they offer a more structured and manageable way to handle asynchronous operations compared to using callbacks directly.



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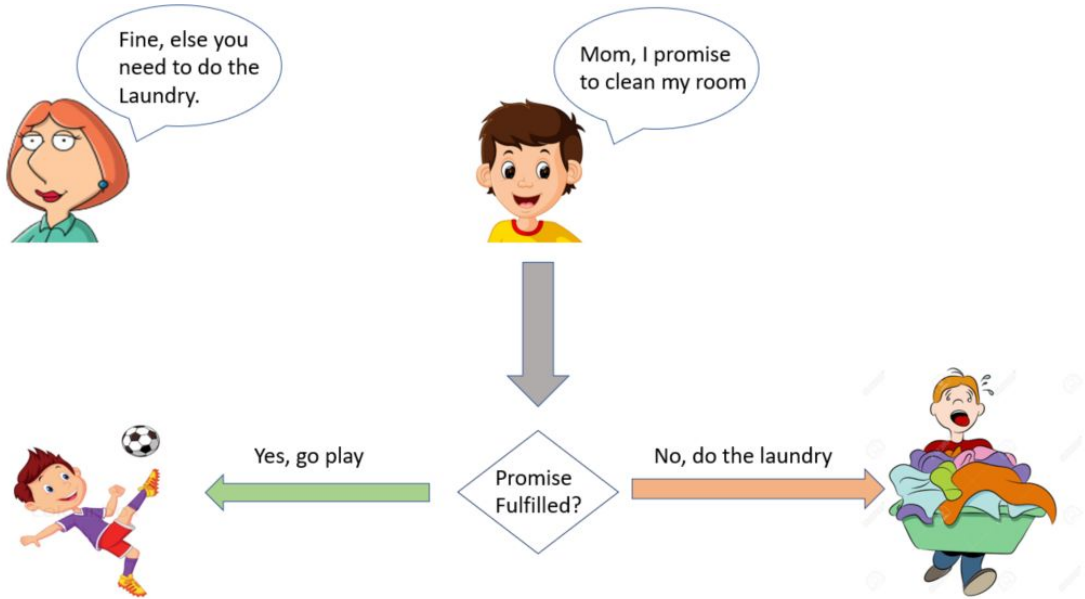
Understanding the Promises

Have you ever made a promise?

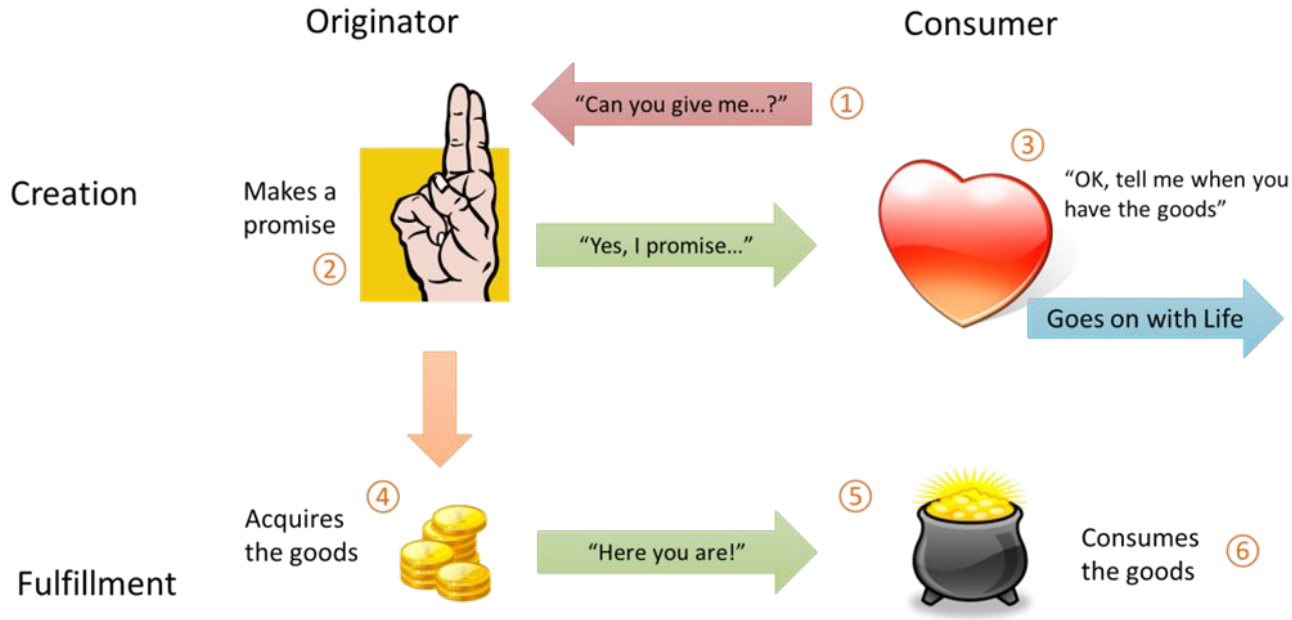
If you did, then you must know how valuable promises are. A promise in real life is a commitment or guarantee made by someone.



Sadly, few promises remain unfulfilled.

Stages of promise

If you did, then you must know how valuable promises are. A promise in real life is a commitment or guarantee made by someone.



Promises in Javascript

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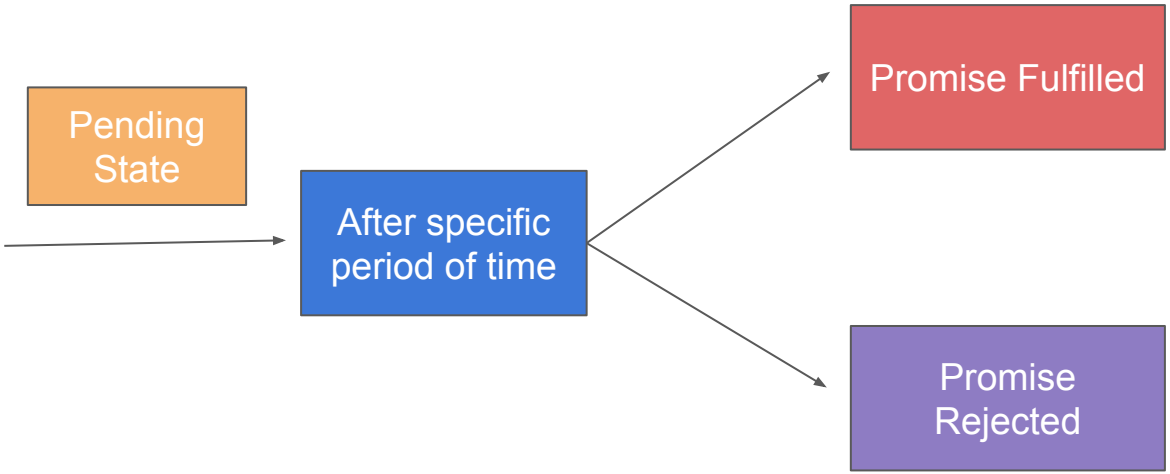
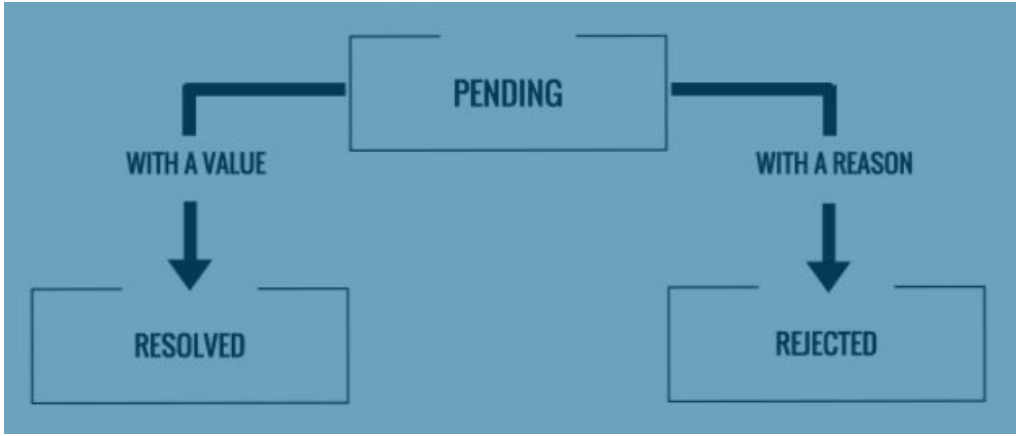
A promise is a commitment in programming—a guarantee that something will happen in the future but not an immediate action. It's a placeholder for future work.



Different promise states

Promises in Javascript exist in three states: pending, fulfilled, and rejected.



Initially, a promise remains in a pending state, and after some time it either gets resolved/fulfilled or rejected.

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Creating Promises

Promise: constructing a promise

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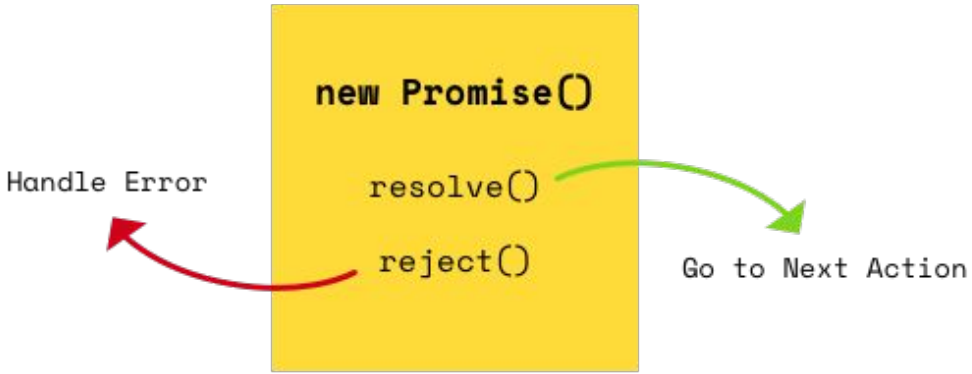
To create a promise in JavaScript, you use the Promise constructor. The promise constructor receives two functions as arguments: resolve() and reject()



The resolve function is called when the promise is successfully fulfilled.

The reject function is called when the promise is rejected.

Promise: Using Promise Constructor

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To create a promise in JavaScript, you use the Promise constructor. The promise constructor receives two functions as arguments: resolve() and reject()

```
1  // Constructor to build a promise
2  const myPromise = new Promise((resolve, reject) => {
3      // Body of Promise
4
5      // Here we can either resolve
6      // Or rejct promise conditionally
7
8  });
```

Received resolve and reject functions as arguments

Promise: resolve()

The resolve method in JavaScript is a static method of the Promise object. It is used to create a promise that is resolved with a given value.

Promised to complete the task in meeting

Resolved the task and provided the work data as return value

resolve() function's work is to finish the task and provide a return value.

Fail/rejected and return fail/error message

reject() function's work is to return an appropriate error message

Promise: resolve()

Let’s have a look at a dummy example:

```
1  // Constructor to build a promise
2  const myPromise = new Promise((resolve, reject) => {
3      // Simulation of success in resolving promise
4      const success = true;
5
6      if(success === true){
7          resolve("Promise got resolved");
8      }
9  });
```

On successful resolution of promise, resolve() returns a value. For simplicity, we are returning a success message.

Promise: reject()

It might be possible that a promise can't be delivered and you need to provide an explanation and, in JavaScript, an error message.

Promised to complete the task in meeting

Resolved the task and provide the work data as return value

resolve() function work is to finish the task and provide a return value.

Fail/rejected and return fail/error message

reject() function work is to return an appropriate error message

Promise: reject()

Let’s have a look at a dummy example:

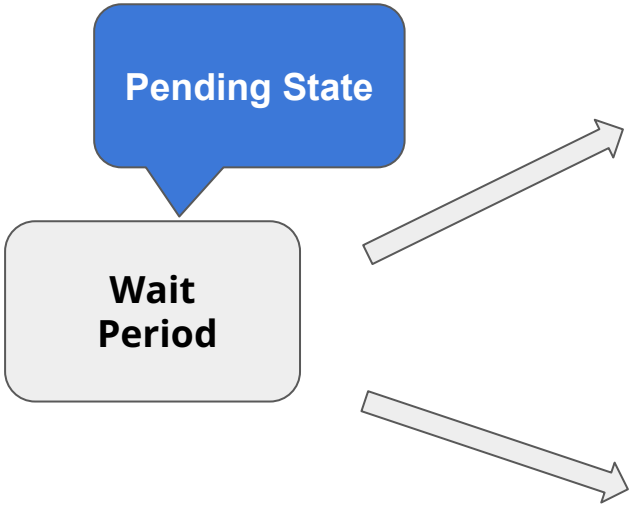
```
1  const myPromise = new Promise((resolve, reject) => {
2      // Simulation of success in resolving promise
3      const success = false;
4
5      if(success === true){
6          resolve("Promise got resolved");
7      } else {
8        reject("Promise got rejected");
9      }
10 });
```

On failure to resolve a promise reject() returns an error message. For simplicity we are returning a failure message..

Promise: pending()

Before either promise gets resolved or rejected, there is some wait period. This wait period is called pending state of promise

Promised to complete the task in meeting



Resolved the task and provided the work data as return value

Fail/rejected and return fail/error message

Promise Creation: Example 1

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Let’s understand promises with a simple example:

```
1  // Constructor to build a promise
2  const myPromise = new Promise((resolve, reject) => {
3      // Asynchronous Operation
4      const success = true; // Simulating a condition
5
6      if(success === true){
7          resolve("Promise got resolved!");
8      } else{
9          reject("Promise got rejected!");
10     }
11 });
```

Using resolve() to fulfill the promise

Using reject() to reject the promise

Promise Creation: Example 2

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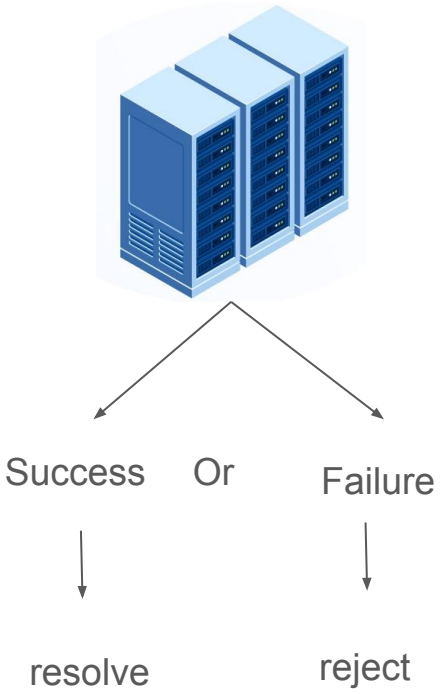
Let’s take a more practical example:

```
1  // Simulating a function that fetches data from a server
2  function fetchDataFromServer() {
3      return new Promise((resolve, reject) => {
4        const serverStatus = false;
5        // Simulate server failure (false means failed)
6
7        if (serverStatus) {
8          resolve('Data fetched successfully');
9        } else {
10         reject('Error: Server is down');
11       }
12     });
13 }
```



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Handling the Promise

Promises: Handling Promise Outcomes

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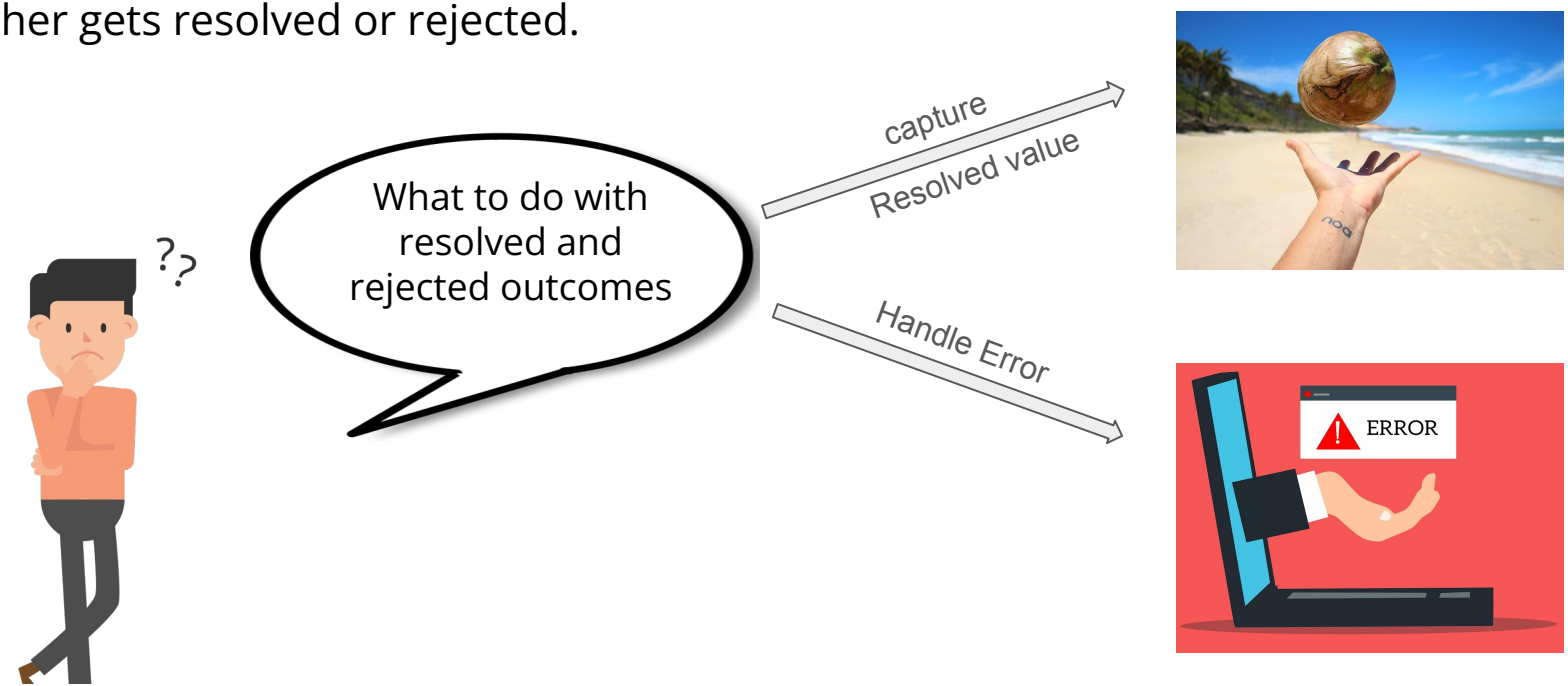
As we have learned, a promise is initially in a pending state, and then after a while it either gets resolved or rejected.



Promises: Bridging Hope and Reality

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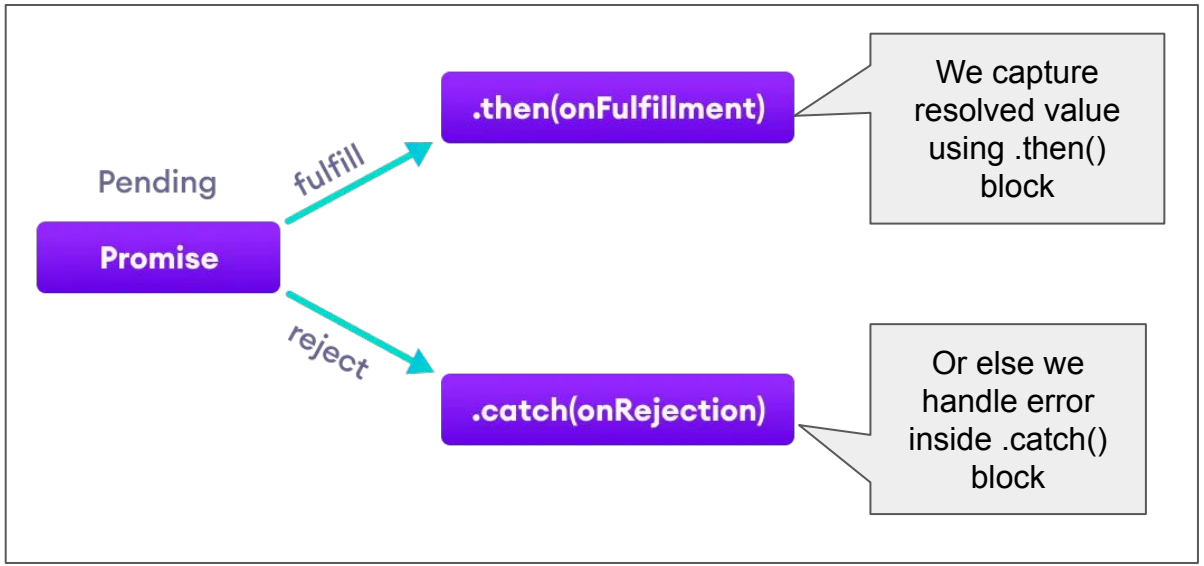
We hope a promise resolves/fulfilled and gives us a value to work with in the “then” block. However, if it gets rejected, we handle it in the “catch” block.



We can add finally at the end (optional)

.finally()

Finally runs, regardless of the promise's result.

Promise: Using the .then() block

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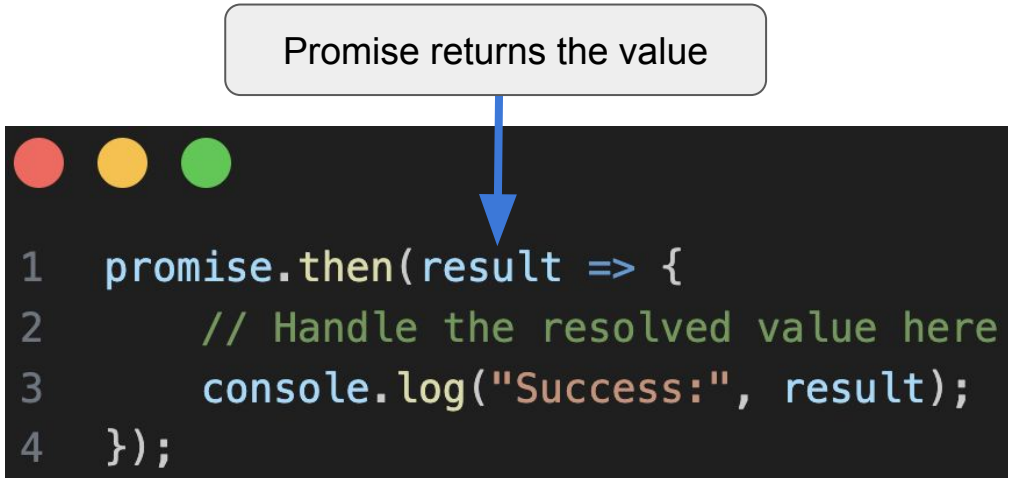
The .then() block handles data after resolution in a promise chain by capturing it and allowing further processing.



We can use the returned value from Promise inside .then() block

.then(): Example

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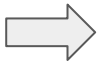
The .then() block is used to handle the successful resolution of a promise, capturing the returned value and allowing further processing or actions.

```
// Simulating a function that fetches data
function fetchDataFromServer() {
    return new Promise((resolve, reject) => {
      const serverStatus = true;
      // Simulate server failure (false means failed)

      if (serverStatus) {
        resolve('Data fetched successfully');
      } else {
        reject('Error: Server is down');
      }
    });
}
```



```
// Using .then()
fetchDataFromServer()
  .then(result => {
    console.log("Success:", result);
    // Handling the resolved value
})
```

Here we are using .then() block to capture the resolved value

Promise: Using .catch() block

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The .catch() block handles errors or rejections in a promise chain, ensuring that any issues during the operation are caught and managed gracefully.

```
1  promise.then(()=>{
2      // then block code
3      })
4      .catch((error)=>{
5          // catch block code
6          console.log("Error: ", error);
7      });
```

.catch() is indeed added after the last .then() block in most cases to handle any errors that occur while consuming the promise.

.catch(): Example

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It might be possible that error occurred while consuming the promise which can be caught using the .catch() block.

```
1  // Using .then()
2  fetchDataFromServer()
3    .then(result => {
4      console.log("Success:", result);
5      // Handling the resolved value
6      })
7      .catch((error) => {
8          console.log("Error: ", error);
9      });
```

Here we are capturing error while consuming the promise.

Promise: Using .finally() block

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It is possible to chain a block that runs regardless of whether the promise is resolved or rejected using .finally() block.

```
promise.then(()=>{
    // then block code
    })
    .catch((error)=>{
        // catch block code
        console.log("Error: ", error);
    })
    .finally(()=>{
        // finally block code
    });
```

.finally(): Example

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It is possible to chain a block that runs regardless of whether the promise is resolved or rejected using .finally() block.

```
1  // Using .then()
2  fetchDataFromServer()
3    .then(result => {
4      console.log("Success:", result);
5      // Handling the resolved value
6      })
7      .catch((error) => {
8          console.log("Error: ", error);
9      })
10     .finally(() => {
11         console.log("Fetch operation completed.");
12         // Executes regardless of success or failure
13     });
```

finally() block

Why do we need Promises??

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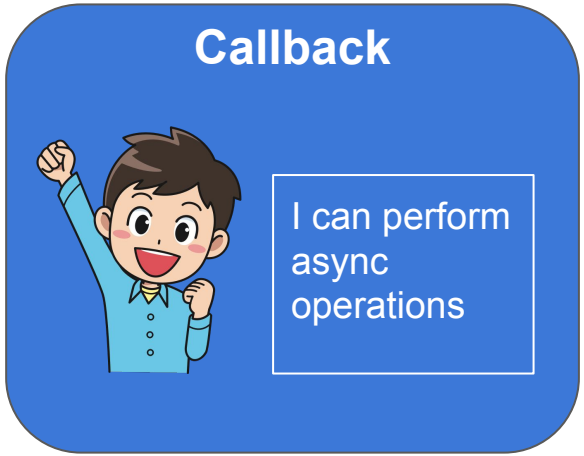
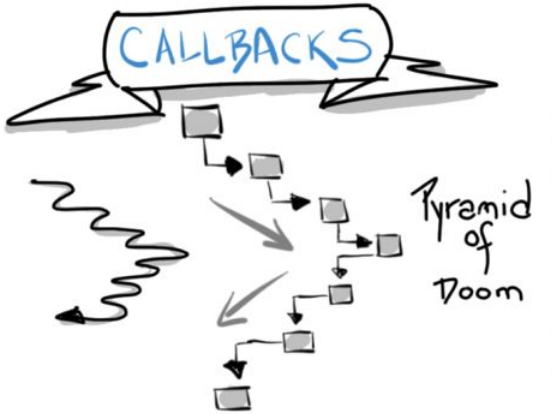
In the previous lecture we learned that callbacks can be used to implement async programming; then why do we need to make promises?





Why do we need Promises??

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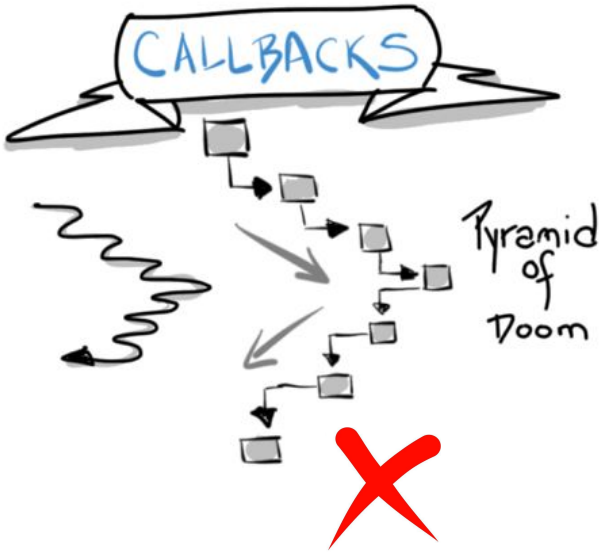
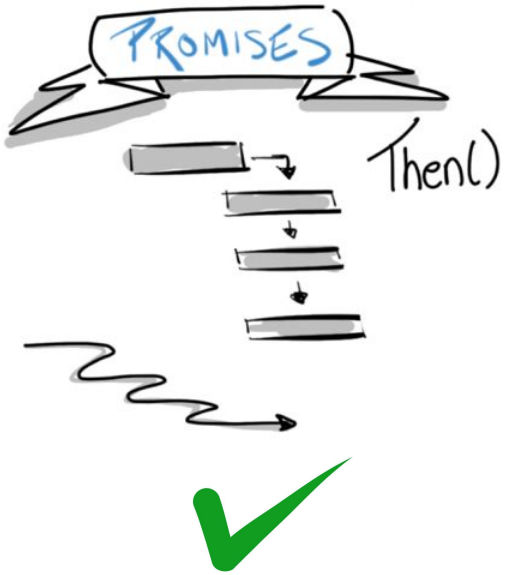
Callbacks can often lead to cluttered and unreliable code due to nested functions. It is better to chain tasks, where one task starts after the previous one ends, and this is achieved using promises.





Callbacks vs Promises vs Async/await

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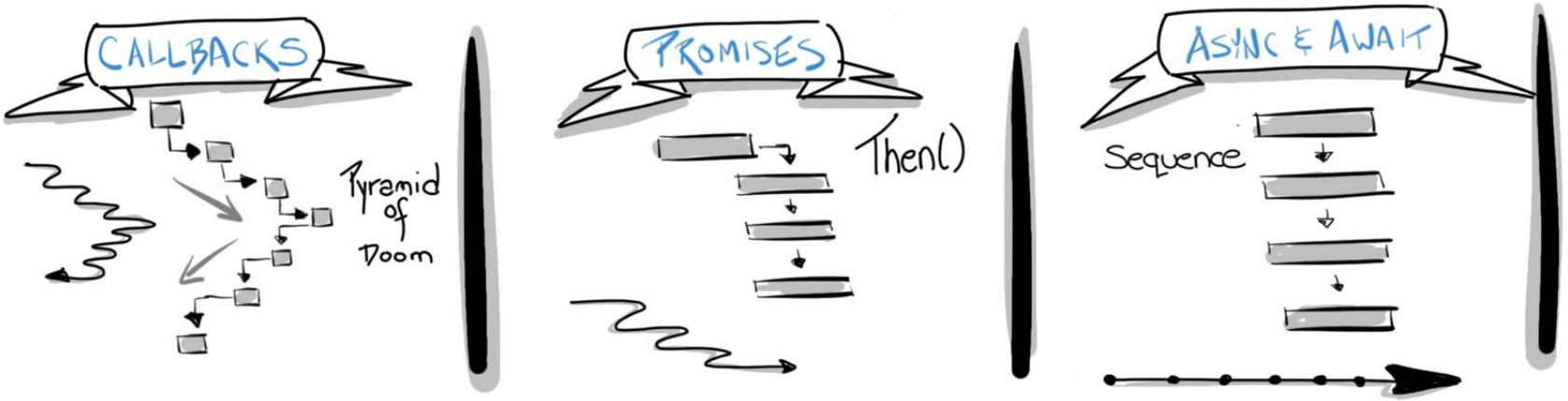
We use callbacks for simple asynchronous tasks, promises for chaining more complex tasks, and async/await for writing asynchronous code that appears sequential.



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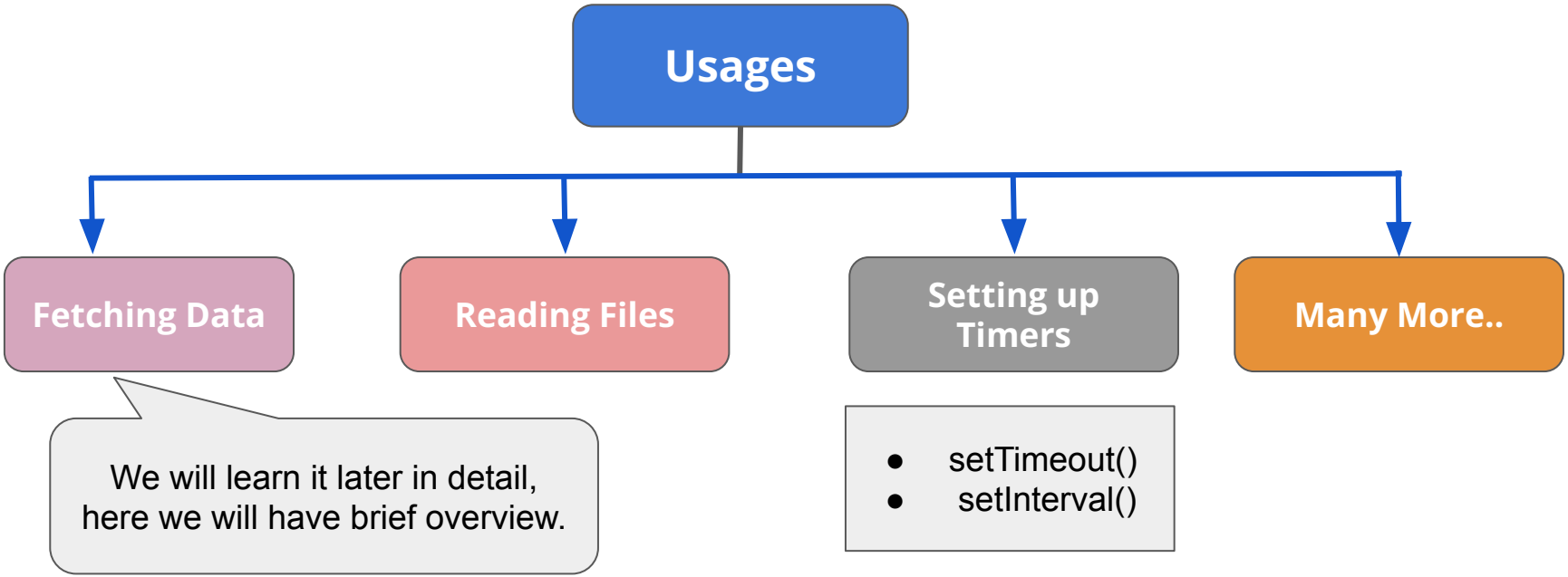
Promise Basic Usages

Basic Promise Usage

Promises in JavaScript simplify handling asynchronous operations. Here are common use cases:



Usage: Fetching Data

We use fetch api to get data from the server.

```
1  // Function to fetch data
2  function fetchData(url) {
3      return new Promise((resolve, reject) => {
4        fetch(url)
5          .then((response) => {
6            if (!response.ok) {
7              // On failure, reject the promise
8              reject(`HTTP error!: ${response.status}`);
9            }
10           return response.json();
11           // Parse JSON from the response
12         })
13         .then((data) => {
14           resolve(data); // On success return data using resolve
15         })
16         .catch((error) => {
17           reject(`Network error: ${error}`); // Reject the promise
18         });
19     });
20 }
```

Fetching data from server is an async operation so we used promise for it.

Here we conditionally rejected/resolved the promise

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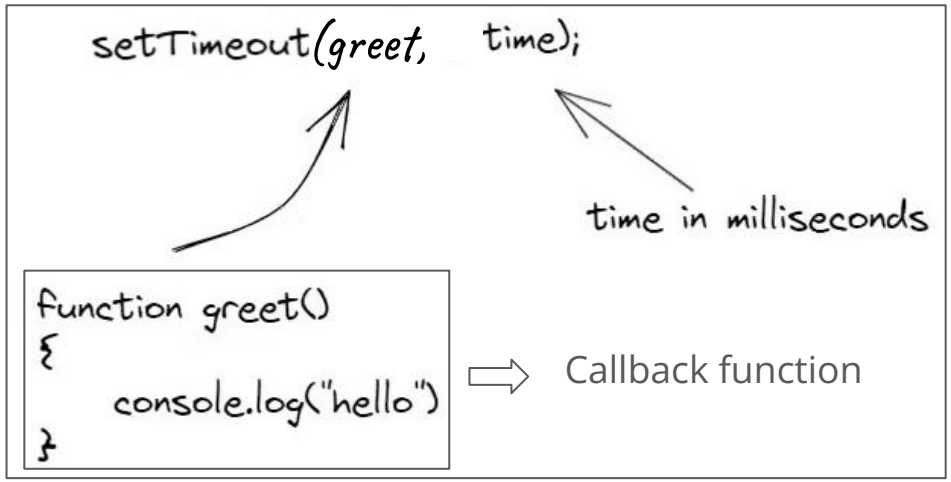
setTimeout and setInterval with Promises

Pre-discussed: setTimeout

setTimeout is a JavaScript function that executes a callback function after a specified delay (in milliseconds).

Syntax:



Pre-discussed: setTimeout Example

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We can print specific message after a certain period of time using setTimeout.

```
1  function greet() {
2      console.log("Hello");
3  }
4
5  // greet function to runs after 2 seconds
6  // i.e. (2000 milliseconds)
7  setTimeout(greet, 2000);
```

Here we get output after 2000 milliseconds i.e. 2 secs

Output:

Hello

setTimeout wrapped in a Promise

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There might be instances where you need to set up timers in JavaScript. In such cases, you can use setTimeout in combination with promises

```
1  function delay(ms) {
2      return new Promise((resolve) => {
3        setTimeout(resolve, ms);
4        // Resolve the promise after a delay (in ms)
5      });
6  }
7
8  delay(2000).then(() => {
9      console.log("Executed after 2 seconds");
10 });
```

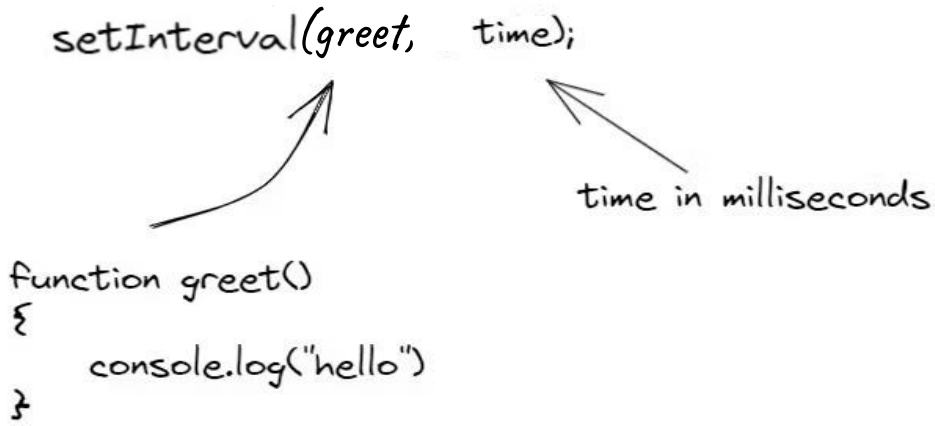
Creating and returning a promise

Calling the function returning the promise and consuming the returned promise

Pre-discussed: setInterval

setInterval is a JavaScript function that repeatedly executes a specified callback function at fixed time intervals (in milliseconds).

Syntax:



Pre-discussed: setInterval example

Here we are printing and updating message count every 1000 milliseconds. The setInterval() function returns a unique identifier, known as an interval ID, which is stored to later clear the interval

```
let count = 0;

const intervalId = setInterval(() => {
    console.log(`Message ${++count}`);
}, 1000);
```

Output:

Message 1

Message 2

Message 3

..

..

Usage: Setting up timers (SetInterval)

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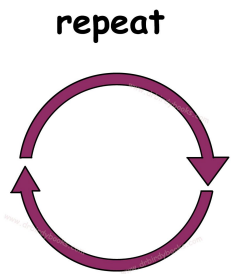
In similar fashion you can use setInterval if you want a task to be repeated after certain interval of time.

```
1  function repeatTask(ms) {
2      return new Promise(() => {
3        setInterval(() => {
4          console.log("Repeating task...");
5        }, ms);
6      });
7  }
8
9  console.log("Starting...");
10
11 repeatTask(2000);
12
13 console.log("Waiting...");
```

Creating and returning a promise

Calling the function returning the promise.



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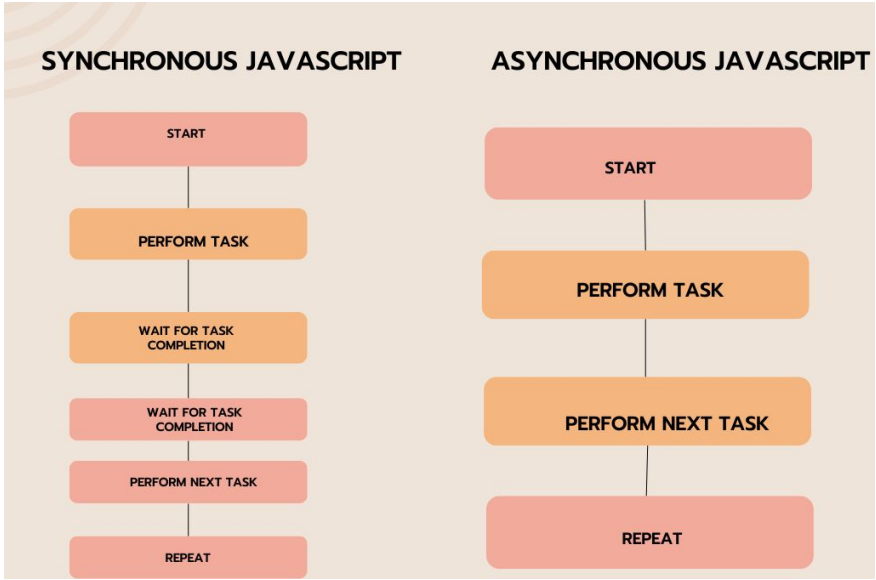
Understanding Asynchronous flow in Promises

What is Asynchronous Flow?

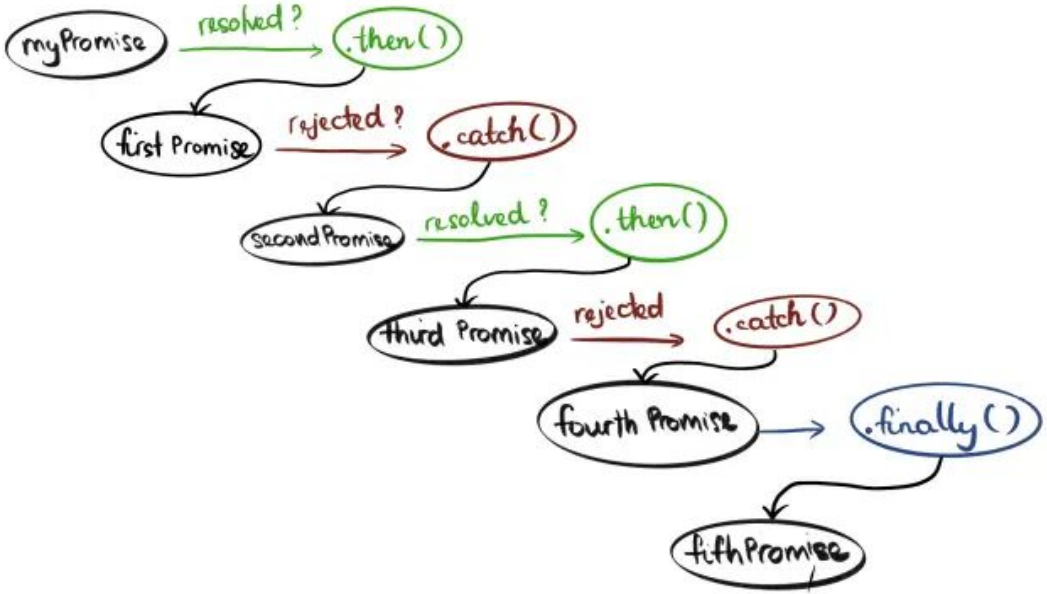
Asynchronous flow allows programs to perform tasks concurrently without blocking other tasks. It enables operations such as fetching data, reading files, or waiting for user input without freezing the program.



Unlike sync operations async operations do not need to wait till the other task complete its execution.

Asynchronous Flow in Promises

In promises we chain the tasks using then() and catch() blocks. Hence program is executed in chain like manner.



Corresponding block executes only after the execution of block previous block.

Workshop: Question

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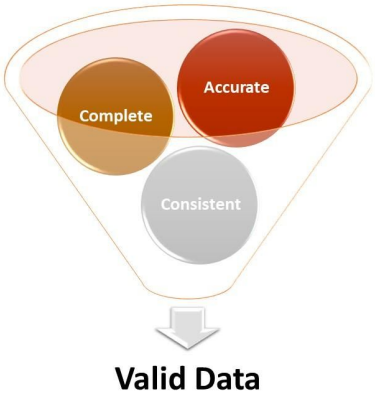
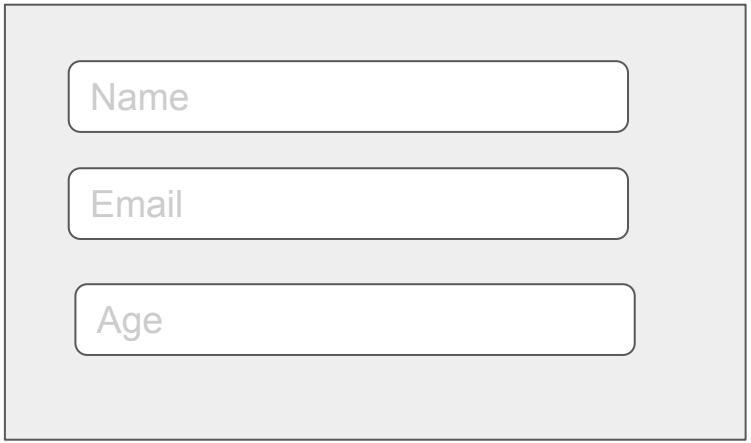
You're building a registration form where users submit their name, email, and age. The input data needs to be validated asynchronously, such as if name is valid, checking if the email is already registered (with a delay) and ensuring the age is valid.

How would you implement using promises?





Workshop: Solution

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Let’s write a function using promises for validating name asynchronously.

```
// Function to validate the name
function validateName(name) {
    return new Promise((resolve, reject) => {
      if (!name.trim()) {
        reject('Name cannot be empty.');
      } else if (name.length < 3) {
        reject('Name must be at least 3 characters long.');
      } else if (/[^a-zA-Z\s]/.test(name)) {
        reject('Name must only contain letters and spaces.');
      } else {
        resolve('Name is valid.');
      }
    });
}
```

Write functions to validate email and age by yourself.

Workshop: Solution

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Let’s write validation functions for email and age too.

```
function validateEmail(email) {
    return new Promise((resolve, reject) => {
      const emailPattern =
        /^[a-zA-Z0-9._-]+@[a-zA-Z0-9.-]+\.[a-zA-Z]{2,6}$/;
      if (!emailPattern.test(email)) {
        reject('Invalid email format.');
      } else {
        resolve('Email is valid.');
      }
    });
}
```

Validating Email

```
function validateAge(age) {
    return new Promise((resolve, reject) => {
      if (isNaN(age) || age < 18) {
        reject('Must be a number and at least 18.');
      } else {
        resolve('Age is valid.');
      }
    });
}
```

Validating Age

In Class Questions

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References

1. **MDN Web Docs - JavaScript**: Comprehensive and beginner-friendly documentation for JavaScript.
   https://developer.mozilla.org/en-US/docs/Web/JavaScript
2. **Eloquent JavaScript**: A free online book covering JavaScript fundamentals and advanced topics.
   https://eloquentjavascript.net/
3. **JavaScript.info**: A modern guide with interactive tutorials and examples for JavaScript learners.
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4. **freeCodeCamp JavaScript Tutorials**: Free interactive lessons and coding challenges to learn JavaScript.
   https://www.freecodecamp.org/learn/

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Thanks for watching!