

JavaScript

# Understanding JavaScript Promises

Handling Asynchronous Operations Like a Pro  
Part 1/3

May 10, 2025



Source Code

# 1. What's the Deal with Promises?

Asynchronous operations are fundamental in modern JavaScript, enabling tasks like fetching data, reading files, or handling user interactions without blocking the main thread. However, managing the flow and potential errors of these operations can be complex. This is where **Promises** provide a robust solution.

## 1.1. Why Promises?

Consider an operation that takes time to complete, such as requesting data from an API. A synchronous approach would halt script execution until the data arrives, leading to unresponsive applications. Promises offer a way to handle such asynchronous tasks effectively.

They act as placeholders for a future value, representing the eventual result of an asynchronous operation. Instead of blocking, the operation is initiated, and the promise object is returned immediately. This allows the rest of the script to continue running.

Promises improve upon older asynchronous patterns like callbacks by providing:


- A clearer, more manageable structure for handling results or errors.
- Better composability for chaining multiple asynchronous operations.
- A standardized way to manage asynchronous flow, reducing complexity (often referred to as "callback hell").

A Promise exists in one of three states:



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- **Pending**: The initial state; the asynchronous operation has not yet completed.
- **Fulfilled (Resolved)**: The operation completed successfully, and the promise holds the resulting value.
- **Rejected**: The operation failed, and the promise holds the reason (typically an error object).

Once a promise transitions from pending to either fulfilled or rejected, it becomes **settled**, and its state and value (or reason) become immutable.

## 2. Creating Your First Promise

Let's make a simple promise. We'll simulate an async task using `setTimeout`.

### How to Run:

- Save the code below as `01_creating_promise.js`.
- Open your terminal and run: `node 01_creating_promise.js`
- Or, paste the code directly into your browser's developer console.




```
1 // --- 01_creating_promise.js ---
2 // How to run:
3 // 1. Open your browser's developer console (usually F12).
4 // 2. Paste this entire code block and press Enter.
```



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```


5 // OR
6 // 3. Save this code as 01_creating_promise.js.
7 // 4. Open your terminal and run: node
    01_creating_promise.js
8
9 console.log("Creating a promise...");
10
11 // A promise takes a function (the 'executor') with two
    arguments: resolve and reject.
12 const myFirstPromise = new Promise((resolve, reject) => {
13     console.log("Executor function started (simulating async
        work)...");
14     const success = Math.random() > 0.5; // Simulate success
        or failure randomly
15
16     // Simulate an asynchronous operation (like fetching
        data) using setTimeout
17     setTimeout(() => {
18         if (success) {
19             const data = { message: "Yay! Data fetched
                successfully!" };
20             console.log("Async work finished: Resolving the

```



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```


    promise.");
21     resolve(data); // If successful, call resolve with
    the result
22   } else {
23     const error = new Error("Oops! Something went
    wrong.");
24     console.log("Async work finished: Rejecting the
    promise.");
25     reject(error); // If failed, call reject with an
    error
26   }
27 }, 2000); // Simulate a 2-second delay
28 });
29
30 console.log("Promise created. It's now 'pending'.");
31
32 // We'll see how to handle the result (resolve/reject) in
    the next example!
33 // For now, this just shows the creation and the state
    changes.
34
35 // You might see 'undefined' logged after 'Promise

```



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```
    created...'
36 // That's the return value of the last console.log, not
    related to the promise itself.
```

When you run this:

- The `new Promise(...)` creates the promise.
- The executor function `(resolve, reject) => {...}` runs immediately.
- The `setTimeout` schedules the success/failure logic to run after 2 seconds.
- The code continues, logging "Promise created...". The promise is **pending**.
- After 2 seconds, `setTimeout`'s callback runs, calling either `resolve` (making the promise fulfilled) or `reject` (making it rejected).

But how do we actually \*use\* the result or handle the error?

### 3. Handling Promises: `.then()`, `.catch()`, `.finally()`


Okay, we made a promise. Now, how do we react when it settles (fulfills or rejects)? We use special methods attached to the promise:

- `.then(onFulfilled, onRejected)`: Attaches callbacks for when the promise is fulfilled (first argument) or rejected (second argument - less common, usually use `.catch()`).



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- `.catch(onRejected)`: Attaches a callback specifically for when the promise is rejected. It's like a `try...catch` block for promises.
- `.finally(onFinally)`: Attaches a callback that runs *always*, whether the promise was fulfilled or rejected. Great for cleanup tasks (like hiding a loading spinner).

Let's handle the promise we created earlier:

### How to Run:

- Save the code below as `02_then_catch_finally.js`.
- Open your terminal and run: `node 02_then_catch_finally.js`
- Or, paste the code directly into your browser's developer console.

```


1 // --- 02_then_catch_finally.js ---
2 // How to run:
3 // 1. Open your browser's developer console (usually F12).
4 // 2. Paste this entire code block and press Enter.
5 // OR
6 // 3. Save this code as 02_then_catch_finally.js.
7 // 4. Open your terminal and run: node
   02_then_catch_finally.js
8

```



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```
9 console.log("Creating a promise...");
10
11 const myDataPromise = new Promise((resolve, reject) => {
12   console.log("Executor: Simulating fetching data...");
13   const success = Math.random() > 0.3; // Higher chance of
      success
14
15   setTimeout(() => {
16     if (success) {
17       const userData = { id: 123, name: "Alex", email:
"alex@example.com" };
18       console.log("Executor: Data fetched! Resolving...");
19       resolve(userData);
20     } else {
21       const error = new Error("Network Error: Could not
fetch user data.");
22       console.log("Executor: Failed to fetch data.
Rejecting...");
23       reject(error);
24     }
25   }, 1500); // Simulate 1.5 seconds delay
26 });
```

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```
27
28 console.log("Promise created. Waiting for it to
    settle...");
29
30 // --- Handling the Promise ---
31
32 myDataPromise
33   .then((data) => {
34     // This function runs ONLY if the promise is resolved
    (successful)
35     console.log("\n.then() block executed:");
36     console.log("Received data:", data);
37     console.log('Welcome, ${data.name}!');
38     // You can return a value here to be used in the next
    .then() (chaining - next topic!)
39     return data.id;
40   })
41   .catch((error) => {
42     // This function runs ONLY if the promise is rejected
    (failed)
43     console.error("\n.catch() block executed:");
44     console.error("An error occurred:", error.message);
```

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```


45     // Handle the error gracefully, maybe show a message
    to the user
46     // You can also return a default value or re-throw the
    error
47 })
48 .finally(() => {
49     // This function runs ALWAYS, whether the promise was
    resolved or rejected
50     console.log("\n.finally() block executed:");
51     console.log("Promise has settled (either resolved or
    rejected). Cleanup can happen here.");
52 });
53
54 console.log("\nPromise handler (.then, .catch, .finally)
    attached.");
55 console.log("Execution continues while waiting for the
    promise...");
56
57 // Note: The logs from .then/.catch/.finally will appear
    *after* the last console.log here,
58 // because the promise takes time to settle (due to
    setTimeout).

```



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Key takeaways:

- Handlers (`.then`, `.catch`, `.finally`) are attached to the promise object to react to its settlement.
- These handlers execute asynchronously when the promise settles, not immediately upon attachment.
- `.then()` receives the resolved value as its argument.
- `.catch()` receives the rejection reason (usually an Error object) as its argument.
- `.finally()` receives no arguments and executes regardless of the outcome.

This forms the foundation of promise-based asynchronous programming. Their true power becomes more apparent when chaining multiple operations, which will be covered subsequently.

## 4. Conclusions about JavaScript Promises


In this first part of our exploration of Promises in JavaScript, we have learned:

- **Fundamentals:** Promises are objects that represent the eventual result of an asynchronous operation, allowing for cleaner and more structured code than traditional callbacks.
- **States:** A promise can be in one of three states: pending, fulfilled, or rejected. Once a promise is settled (fulfilled or rejected), its state and value become immutable.



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- **Result Handling:** The `.then()`, `.catch()` and `.finally()` methods provide a clear interface for handling both successful results and errors from asynchronous operations.
- **Organized Asynchrony:** Promises keep code readable even when working with operations that don't complete immediately, making it easier to manage asynchronous execution flow.

Promises are fundamental to modern JavaScript development and form the foundation for more advanced features like `async/await`. In part two, we'll explore promise chaining, methods like `Promise.all()` and `Promise.race()`, and advanced patterns that unlock the full potential of asynchronous programming in JavaScript.


## 5. References

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