PART 4

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FULLSTACK WEB DEV

JAVASCRIPT

JS

ASYNC PROGRAMMING

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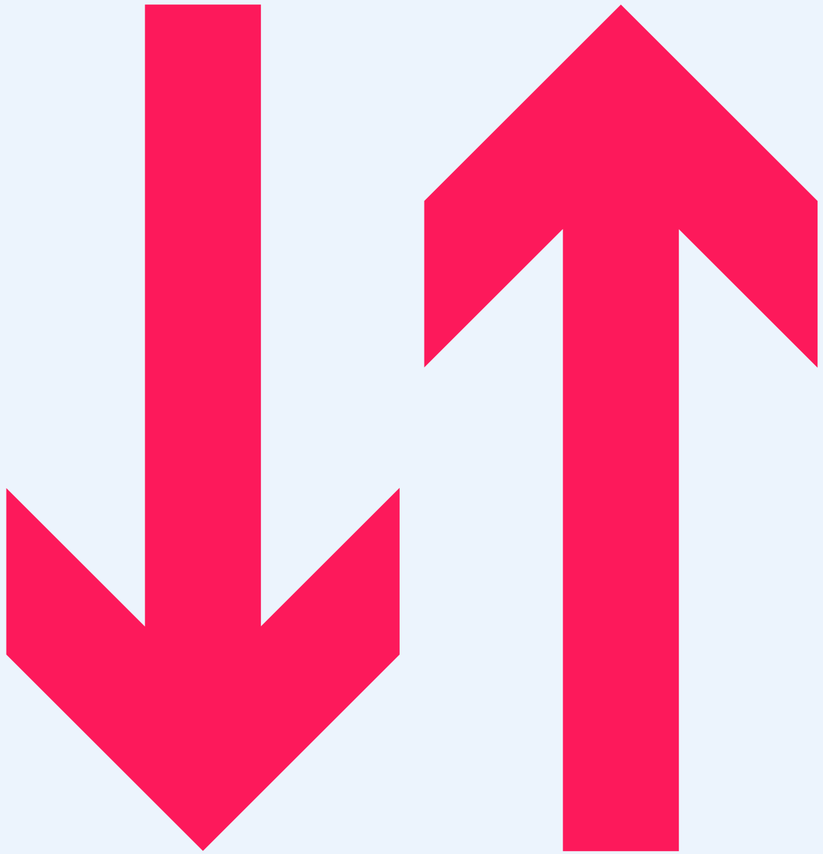

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ASYNCHRONOUS PROGRAMMING

WHAT'S IT?

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WHAT IS ASYNCHRONOUS PROGRAMMING?

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High-Level Explanation

- Asynchronous programming: Non-blocking operations
- Tasks run independently of main program flow
- Ideal for I/O-bound, network, and long-running tasks

Basic Explanation

- Analogy: Synchronous programming like fast-food queue
- Orders block others, wait to complete
- Asynchronous programming: Order, step aside
- Continue tasks while waiting for others

Best Practices

- Keep MongoDB driver up to date for compatibility, security.
- Prefer officially supported, community-maintained drivers for updates, support.

Deep Dive

- Synchronous programming: Sequential execution
- Each operation waits for the previous one
- Limiting for unpredictable tasks
- Asynchronous decouples initiation from execution
- Allows parallel execution while waiting

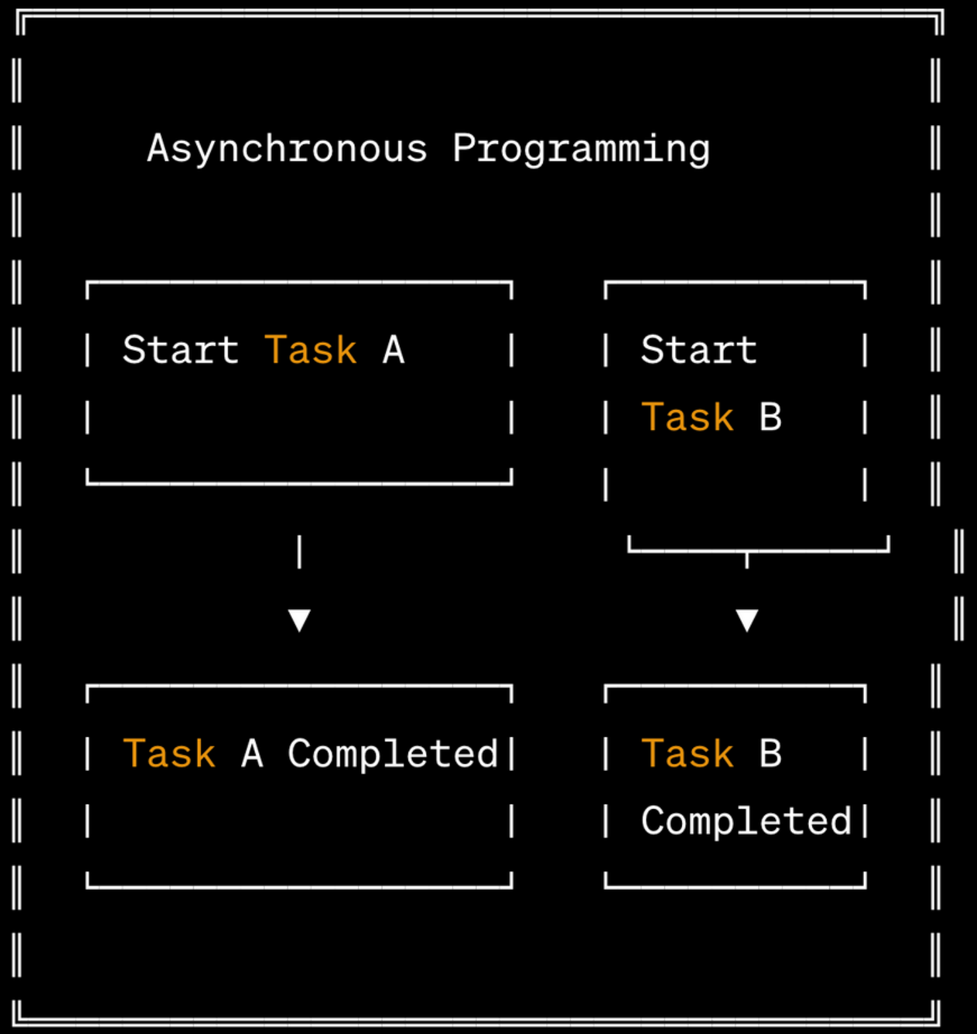
When to use?

- Tasks are time-consuming, no need for sequential completion.
- Building scalable network apps.
- Enhancing UI responsiveness.

Summary

- Asynchronous programming: Independent task execution
- Boosts efficiency, responsiveness
- Ideal for I/O-bound, long tasks
- Best practices like Promises and error handling enhance maintainability.

WHAT IS ASYNCHRONOUS PROGRAMMING?



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IT'S IMPORTANCE

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WHY ASYNCHRONOUS PROGRAMMING IS IMPORTANT

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High-Level Explanation

- Asynchronous programming is crucial in JavaScript.
- Vital for web browsers and Node.js.
- Non-blocking, event-driven architecture enhances performance, usability.

Basic Explanation

- Analogy: Synchronous app freezes while streaming.
- Annoying, can't do anything else.
- Asynchronous: Stream and browse simultaneously.
- Enhances user experience and multitasking.

Best Practices

- Prefer async/await for readability.
- Stick to one approach (callbacks, Promises, async/await).
- Leverage libraries like Axios, fs.promises.
- Implement robust error handling for catch/rejections.

Deep Dive

- JavaScript is single-threaded.
- Synchronous tasks freeze system with time-consuming ops.
- Asynchronous programming prevents freezing.
- Ensures responsive interfaces, resource management.

When to use?

- JavaScript async crucial for:
  - Web dev: Interactions, APIs, DOM without freezing.
  - Node.js backend: Efficient I/O tasks.
  - Real-time apps: Chat, gaming, collaborative tools.

Summary

- JavaScript relies on asynchronous programming for responsive, non-blocking UI and efficient resource use.
- Critical for I/O-bound and concurrent tasks in frontend and backend.
- Best practices ensure code maintainability, user experience.

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ASYNCHRONOUS PROGRAMMING

SYNCHRONOUS VS ASYNCHRONOUS EXECUTION

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SYNCHRONOUS VS. ASYNCHRONOUS EXECUTION

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High-Level Explanation

- Synchronous execution: Tasks sequentially, one by one.
- Wait for each to finish before starting next.
- Asynchronous execution: Tasks run in parallel.
- No need to wait for one to finish before starting another.

Deep Dive

- **Synchronous Execution:**
  - Linear, predictable flow.
  - Blocks until current operation finishes.
  - Simple, easy to follow and debug.
  - Can cause performance issues with time-consuming tasks.

- **Asynchronous Execution:**
  - Non-linear, tasks start/complete differently.
  - Doesn't block; allows concurrent tasks.
  - More complex with callbacks, promises, async/await.
  - Ideal for time-consuming or external-dependent operations.

Basic Explanation

- **Synchronous:** Single-window fast-food, wait for food, next person orders. Large orders delay others.

- **Asynchronous:** Multi-window fast-food, order, move aside, next person orders. Collect when ready, no delays.

SYNCHRONOUS VS. ASYNCHRONOUS EXECUTION

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When to use?

- **Synchronous:** Ideal for ordered execution, simplicity. E.g., basic algorithms, calculations, string manipulations.

- **Asynchronous:** Ideal for I/O-bound, concurrent tasks, independent of others. E.g., web dev (API calls, DOM), backend (DB queries).

Best Practices

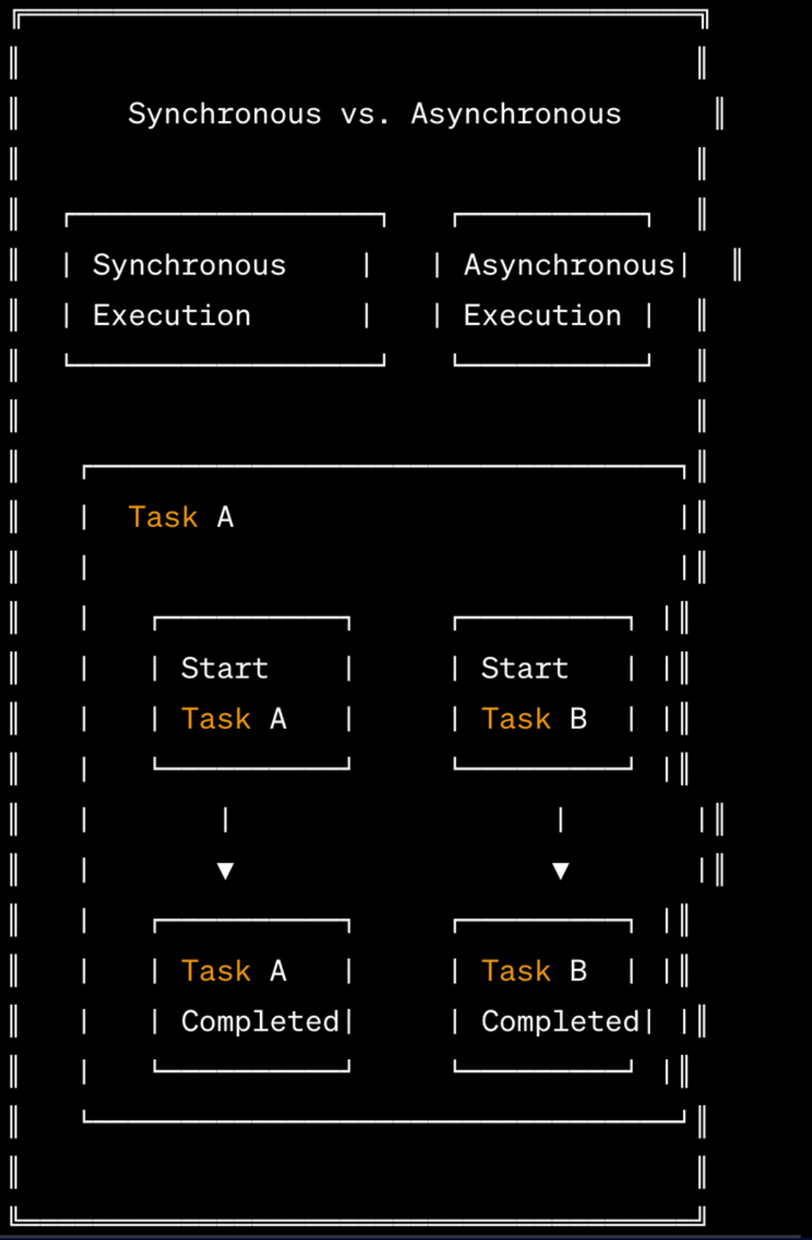
- **Synchronous**
  - Watch for performance bottlenecks.
  - Avoid long-running operations; they can freeze the app.

- **Asynchronous:**
  - Handle errors in async code.
  - Prevent "callback hell" with promises or async/await.
  - Be cautious of race conditions.

Summary

- JavaScript relies on asynchronous programming for responsive, non-blocking UI and efficient resource use.
- Critical for I/O-bound and concurrent tasks in frontend and backend.
- Best practices ensure code maintainability, user experience.

SYNCHRONOUS VS. ASYNCHRONOUS EXECUTION



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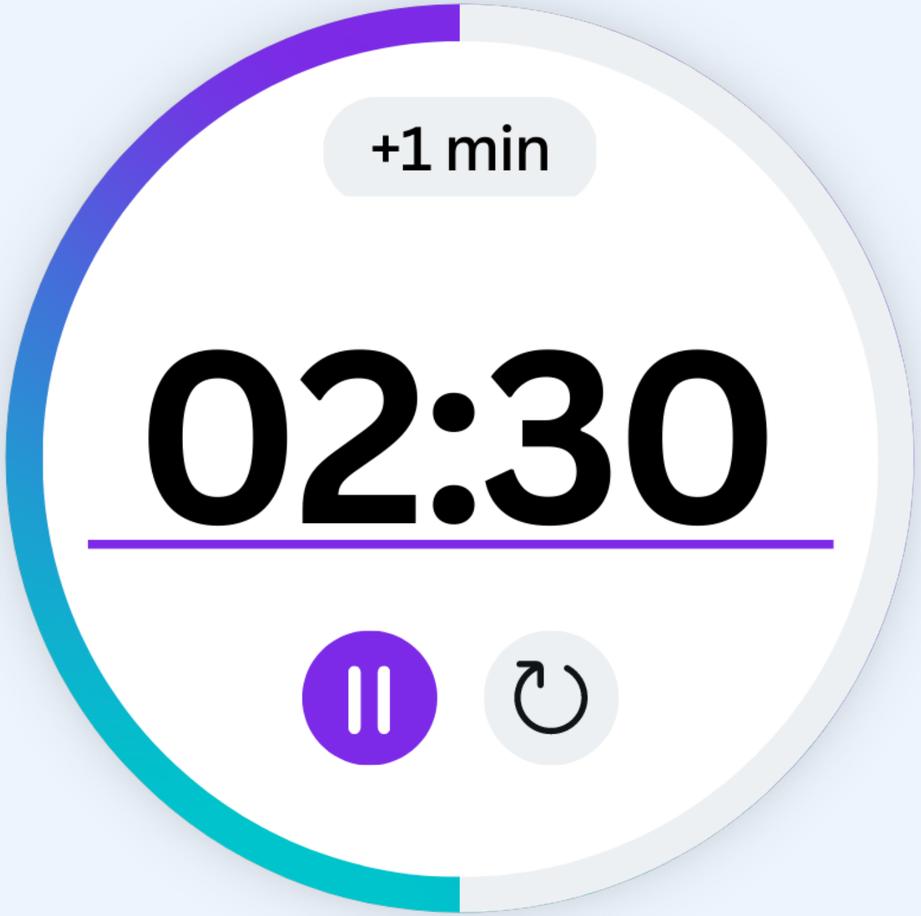
ASYNCHRONOUS PROGRAMMING

SETTIMEOUT

VS

SETINTERVAL



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SETTIMEOUT AND SETINTERVAL FUNCTIONS

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High-Level Explanation

- `setTimeout`: One-time task after delay
- `setInterval`: Recurring task at intervals

Basic Explanation

- setTimeout: Like a one-time alarm reminder
- Rings once and turns off after execution

- **setInterval:** Like a daily repeating alarm
- Rings every day until manually turned off

Best Practices

- Clear intervals/timeouts to prevent issues, memory leaks
- Beware of exact timing reliability due to JS single-threading
- For precision, explore Web Workers or other options

Deep Dive

-setTimeout:
- Schedules callback after specified delay (ms)
- Returns ID for cancellation with `clearTimeout`

- **setInterval:**
- Schedules callback at fixed intervals (ms)
- Returns ID for stopping repetitions with `clearInterval`

When to use?

- **setTimeout:** Ideal for one-time delayed tasks
- Notify after delay, delayed API calls, debouncing input

- **setInterva**l: Ideal for recurring tasks at intervals
- Update live clock, poll API, auto-save content regularly

Summary

- `setTimeout` and `setInterval`: Vital for timed operations
- `setTimeout`: For one-time delayed tasks
- `setInterval`: For recurring tasks at intervals
- Proper usage and management ensure efficiency.

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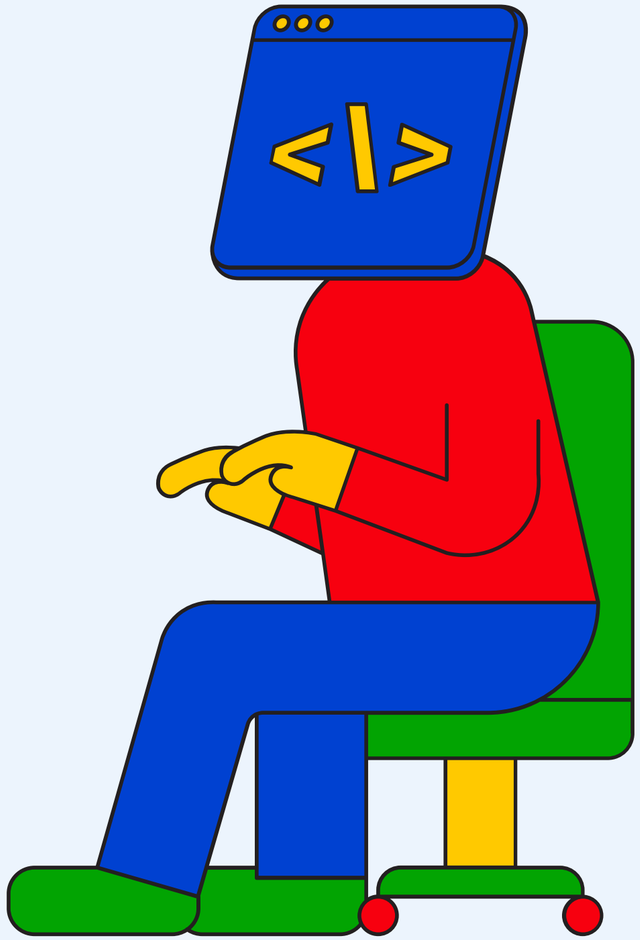
CODE DEMO



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BLOCKING VS NON-BLOCKING CODE

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BLOCKING VS NON-BLOCKING CODE

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High-Level Explanation

- Blocking code: Halts program until completion
- Non-blocking code: Allows program to continue without waiting

Basic Explanation

- **Blocking:** Like waiting in line at a slow coffee order
- **Non-blocking**: Like using multiple self-checkout kiosks, tasks proceed independently

Best Practices

- Avoid long-blocking operations in responsive contexts (UI).
- Use non-blocking code for I/O, especially in Node.js (event-driven).
- Handle errors in non-blocking ops (callbacks, promises, async/await).

Deep Dive

- Blocking Code: Operation completes before next one
- Non-blocking Code: Initiates task and moves on without waiting
- Common in JavaScript for I/O operations

When to use?

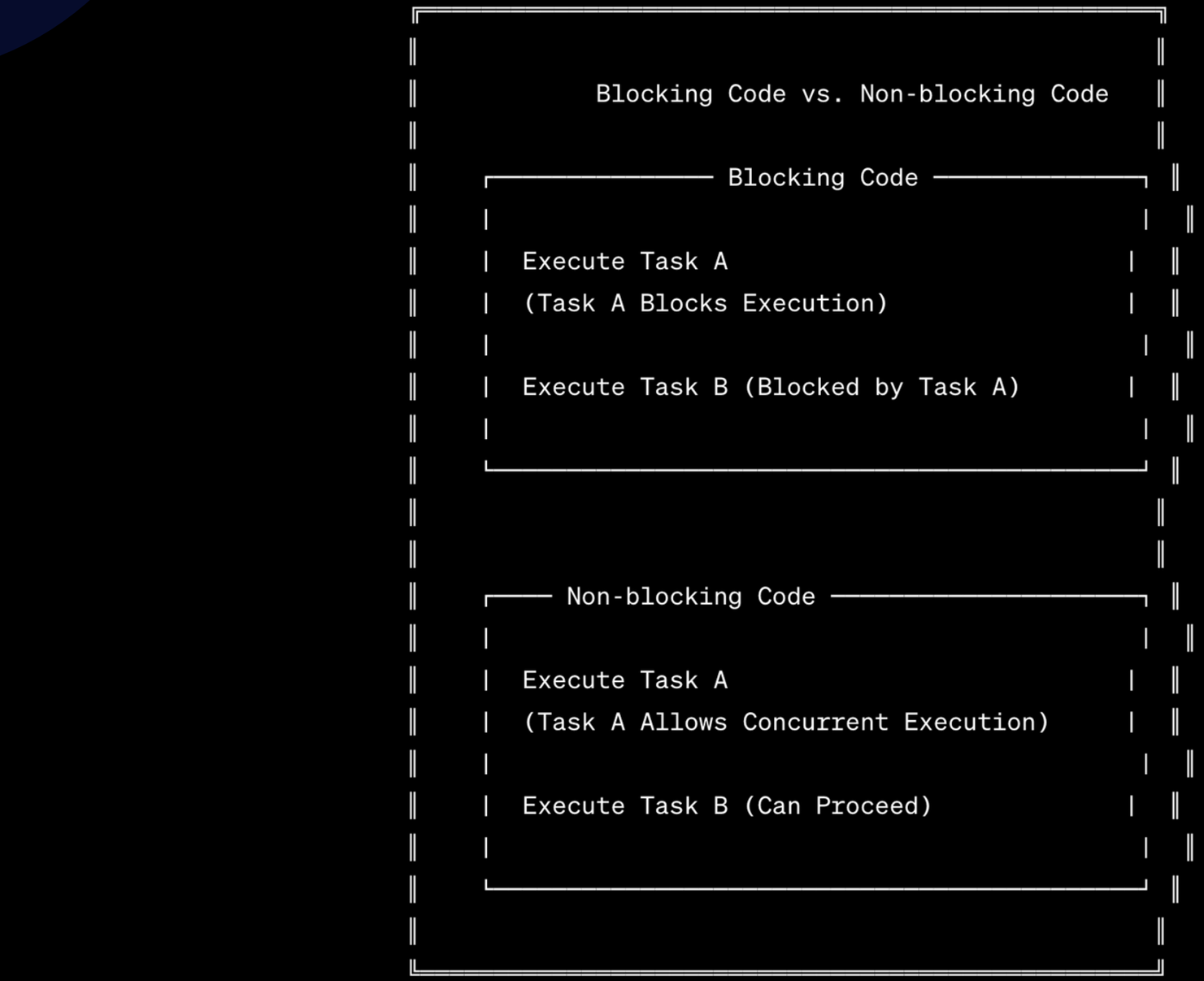
- **Blocking**: Suited for dependent, sequential operations
- Often in scripting tasks, order matters

- **Non-blocking:** Ideal for independent, parallel tasks
- Used in responsive apps, web servers, etc.

Summary

- Blocking and non-blocking code impact execution sequence.
- Blocking waits, non-blocking moves on.
- Proper use ensures efficiency and responsiveness.

BLOCKING VS NON-BLOCKING CODE



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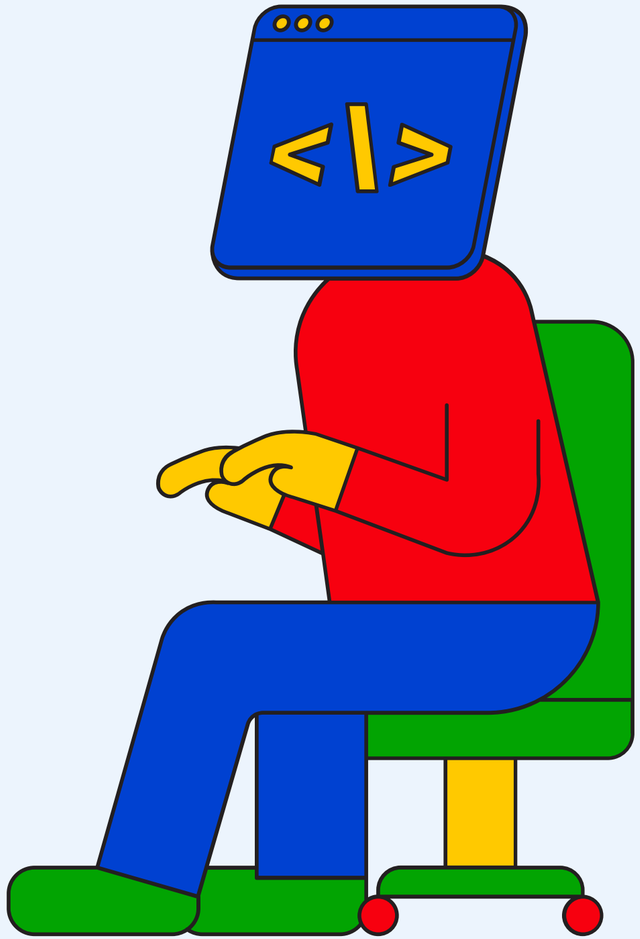

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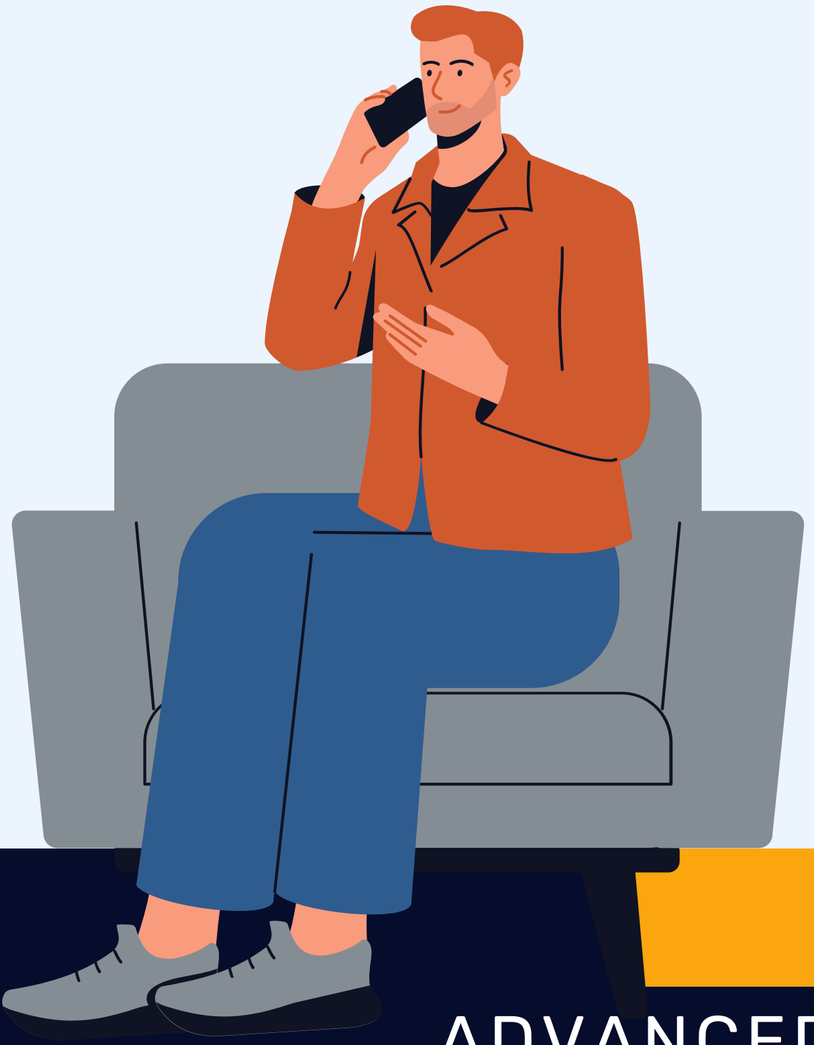
CALLBACKS & EVENT LOOP



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UNDERSTANDING CALLBACK FUNCTION

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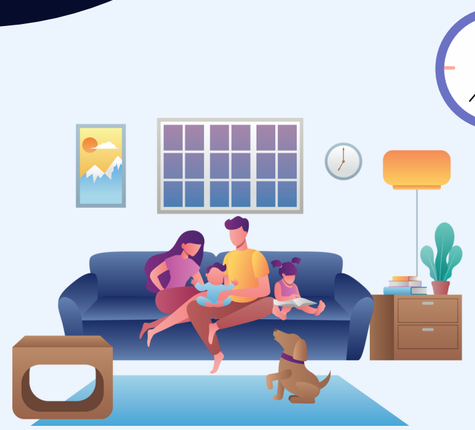
UNDERSTANDING CALLBACK FUNCTIONS



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Callback

UNDERSTANDING CALLBACK FUNCTIONS

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High-Level Explanation

- Callback function: Passed as arg, executed after another function
- Fundamental in JavaScript, crucial for async management

Basic Explanation

- Analogy: Pizza delivery callback
- Give phone number (callback) for delivery notification
- They call (execute) when pizza (data) is ready

Best Practices

- Handle errors in callback functions (often first argument).
- Avoid callback hell (nested callbacks); use Promises or `async/await`.
- Be aware of non-linear code flow in callbacks; debug carefully.

Deep Dive

- JavaScript functions: First-class citizens, passed like values
- Pattern: Pass callback into functions for behavior extension
- Callbacks handle async operations, like API responses

When to use?

- Callbacks used for:
  - Asynchronous operations (file read, API requests, timeouts)
  - Logic/task separation in functions (array methods)
  - DOM event listeners

Summary

- Callback functions in JS: Dynamic, async code execution.
- Passed as args, executed later or under conditions.
- Provide flexibility, manageability; prioritize clarity, error handling.

Defining a Callback Function

Syntax

```
function callbackFunction(parameter) {
  // Code to be executed
}
```

- callbackFunction: Function passed as callback, contains code to execute.

- parameter: Parameters accepted by callback when invoked.

Passing a Callback Function to Another Function

```
function higherOrderFunction(callback) {
  // Code before calling callback

  callback();

  // Code after calling callback
}

higherOrderFunction(callbackFunction);
```

- higherOrderFunction: Function accepting a callback as parameter, controls async operations.

- callback(): Invokes callback function within higher-order function.

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CALLBACK HELL

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CALLBACK HELL (CALLBACK PYRAMID) AND ITS ISSUES

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High-Level Explanation

- Callback Hell (Pyramid of Doom): Heavily nested callbacks.
- Common in async programming, subsequent ops wait for previous.
- Issues: Poor readability, maintenance, error-prone.

Basic Explanation

- Analogy: Callback Hell like stacking boxes.
- Tasks depend on previous, instructions nested.
- Hard to understand, change; changes affect all.

Best Practices

- Modularization: Break down callbacks into modular functions.
- Error Handling: Implement error handling.
- Promises/Async-Await: Transition for cleaner code.
- Comments: Document flow and purpose.
- Limit Nesting: Keep nesting levels minimal for readability.

Deep Dive

- Callback Hell: Nested, sequential async ops.
- Common in dependent async ops (file reads, API calls, DB queries).
- Issues: Poor readability, understanding, modification, debugging, maintenance, error-prone.

When to use?

- Avoiding Callback Hell is ideal, but sometimes complex async ops.
- Use solutions like Promises, Async/Await, Generators for better control.

Summary

- Callback Hell: Nested callbacks, hard-to-read code
- Common in multiple dependent async operations
- Mitigate with modularization, error handling, Promises/Async-Await, comments, nesting limits

CALLBACK HELL (CALLBACK PYRAMID) AND ITS ISSUES

Syntax

```
performOperation1(data, function(result1) {
  |
  |--- performOperation2(result1, function(result2) {
  |       |
  |       |--- performOperation3(result2, function(result3) {
  |       |       |
  |       |       |--- // More Nested Callbacks...
  |       |       |
  |       |       });
  |       |
  |       });
  |
  });
```

CALLBACK HELL (CALLBACK PYRAMID) AND ITS ISSUES

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Syntax

```
fetchUserData(userId, function(userData) {
  |
  |--- fetchUserPosts(userData.id, function(userPosts) {
  |       |
  |       |--- userPosts.forEach(function(post) {
  |       |       |
  |       |       |--- fetchPostComments(post.id, function(comments) {
  |       |       |       |
  |       |       |       |--- // Maybe more nested callbacks for each comment.
  |       |       |       |
  |       |       |       });
  |       |       |
  |       |       });
  |       |
  |       });
  |
  });
```

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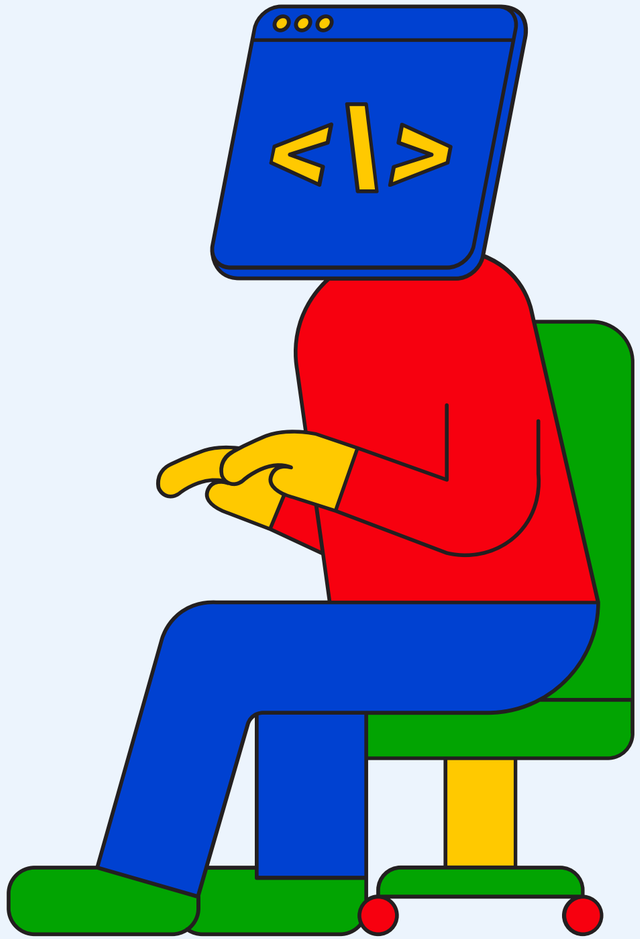
CODE DEMO



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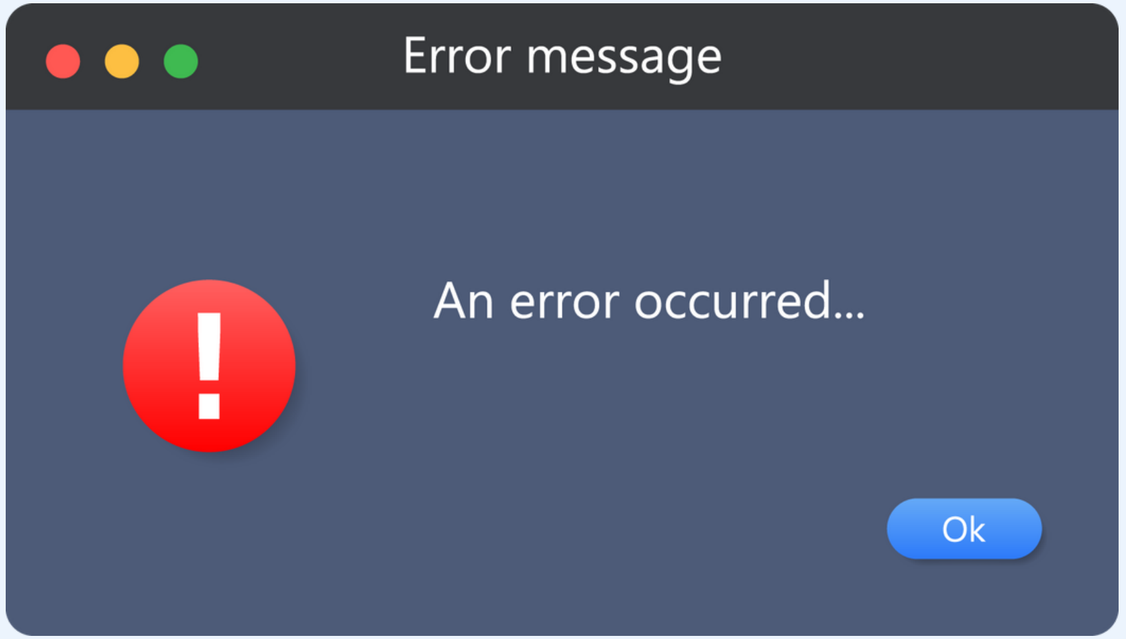
HANDLING ERRORS IN CALLBACK



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HANDLING ERRORS IN CALLBACKS

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High-Level Explanation

- Robust async JS requires error handling in callbacks.
- Error-first callback style: 1st arg for error, 2nd for result.

Basic Explanation

- Analogy: Error-first callbacks like asking a friend for a task
- Friend calls back, first mentions any problem (error)
- If all good, then shares the task result
- Error known before result

Best Practices

- Check for errors before processing results.
- Propagate errors for proper handling.
- Graceful error handling: Fallbacks, informative messages.
- Minimize excessive callback nesting for simplicity.

Deep Dive

- Effective error management in async callbacks is crucial.
- Error-first callback: Error passed as 1st argument.
- Enables graceful error handling; `null` if no error, result as 2nd arg.

When to use?

- Error-first pattern valuable for async ops with likely errors.
- Applied in file reading, network requests, database queries.
- Ensures error handling, robust, reliable code.

Summary

- Error handling in async JavaScript is crucial.
- Error-first callback: 1st arg error, 2nd result.
- Ensures error awareness, code robustness, and maintainability.
- Best practices: error checks, propagation, minimal nesting.

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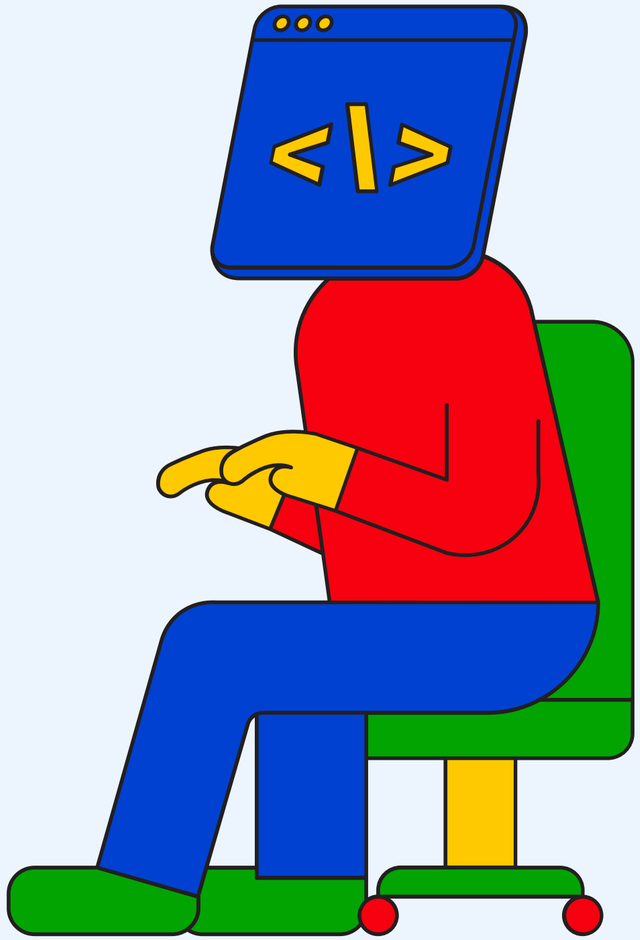
CODE DEMO



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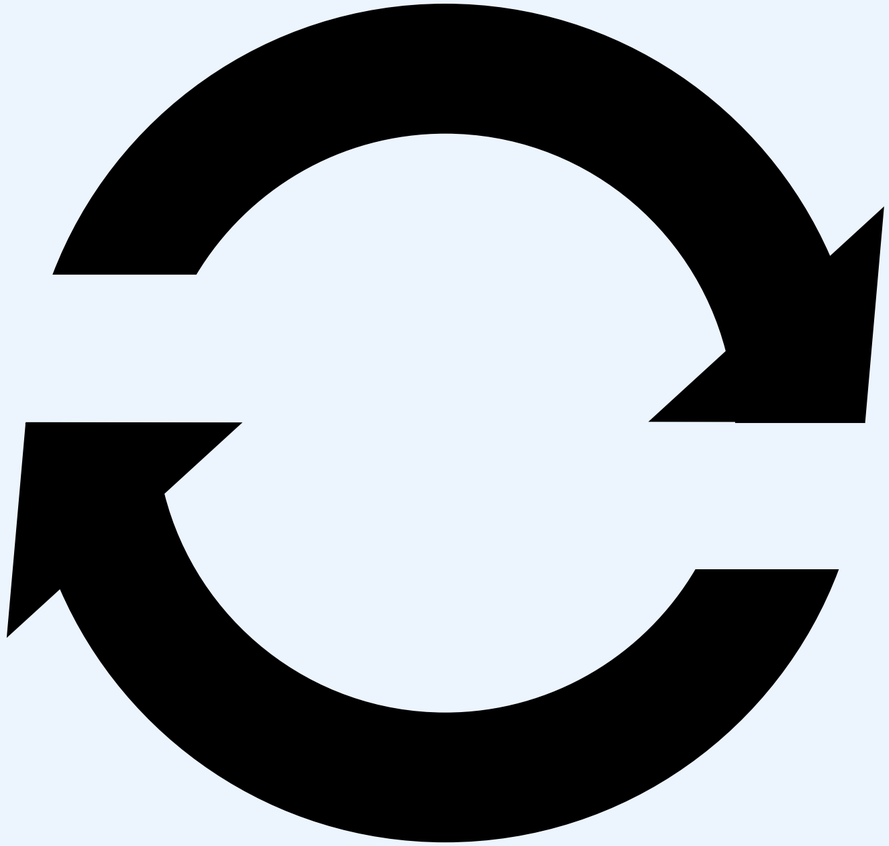
EVENT LOOP



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THE JAVASCRIPT EVENT LOOP

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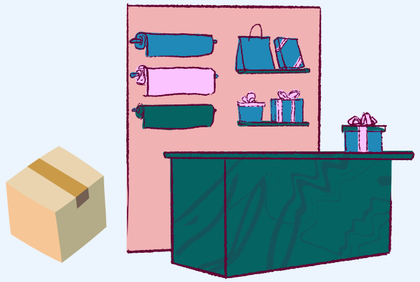
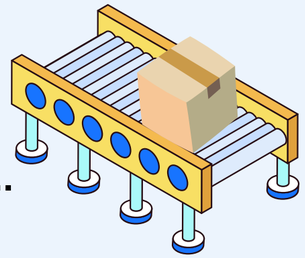
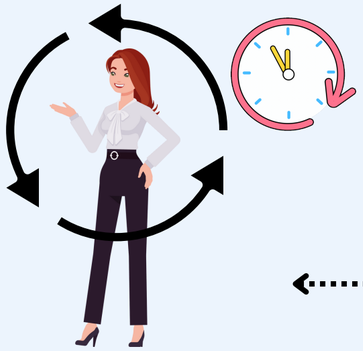
checkout counter(Call Stack)



wrapping station (Web API)



conveyor belt (Callback Queue)



A manager (Event Loop)

THE JAVASCRIPT EVENT LOOP

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High-Level Explanation

- JavaScript Event Loop: Core of async behavior
- Collaborates with Call Stack, Callback Queue, Web APIs
- Orchestrates task execution, keeps JS non-blocking, responsive

Basic Explanation

- Analogy: JavaScript runtime components as a store checkout
- **Call Stack**: Regular items checked out directly.
- **Web APIs:** Special items sent for gift-wrapping (async).
- **Callback Queue:** Wrapped items on conveyor belt (awaiting checkout).
- **Event Loop:** Manager schedules wrapped items once counter is free.

Deep Dive

- JavaScript runtime components:
  - **Call Stack**: Functions executed one at a time, single-threaded.
  - **Web APIs:** Offload async tasks like `setTimeout`.
  - **Callback Queue:** Stores async callback tasks.
  - **Event Loop:** Monitors Call Stack and Callback Queue.
    - Dequeues callbacks to Call Stack when it's empty.

Best Practices

- Avoid long-running tasks to prevent Call Stack blocking.
- For heavy computations, consider Web Workers.
- Handle errors in async code to prevent issues.
- Minimize callback hell; use Promises or async/await for cleaner code.

Summary

- JavaScript runtime uses Call Stack, Web APIs, Callback Queue, Event Loop.
- Manages both sync and async tasks.
- Non-blocking, concurrent handling for smooth user experience.
- Proper coding practices maximize system efficiency.

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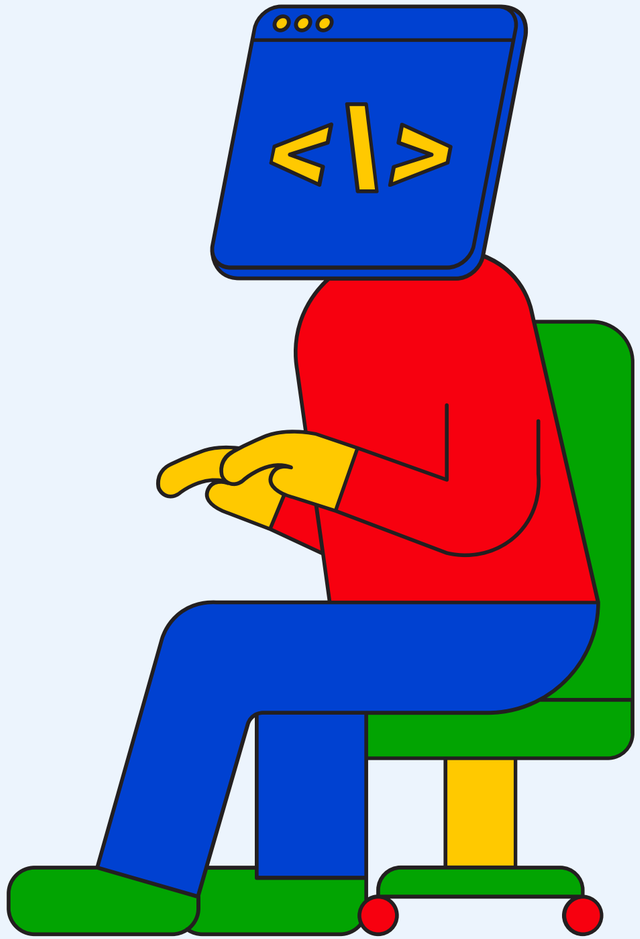
CODE DEMO



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PROMISES

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INTRODUCTION TO PROMISES

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INTRODUCTION TO PROMISES

initiating a Promise (Creation)

WEB API

waiting period (Pending State)

cancelled (rejected)

Served (fulfilled)

INTRODUCTION TO PROMISES

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High-Level Explanation

- JavaScript Promises represent async operation results.
- States: pending, fulfilled, rejected.

Basic Explanation

- Analogy: Promise as ordering a meal at a restaurant
- Order initiation = Promise
- Pending state = Waiting for meal, given a token
- Fulfilled = Meal served, Promise fulfilled
- Rejected = Order canceled, Promise rejected

Best Practices

- Handle errors with `.catch()` to prevent silent failures.
- Return new promises from `then()` for nested promises.
- Minimize promise nesting.
- Chain promises for readability, error handling.
- End promise chain with `catch()` for error handling.

Deep Dive

- Promise: Represents async operation completion or failure.
- Attach callbacks to a returned object.
- Fulfilled (successful) or rejected (failure).
- Returns a promise for the future value, like sync methods.

When to use?

- Promises suitable for async ops like web requests.
- Handle unknown outcomes, non-immediate completion.
- Avoid callback hell, manage async code more comfortably.

Summary

- Promises represent async operation results: pending, fulfilled, rejected.
- Ideal for managing async operations and code.
- Best practices include error handling, avoiding promise nesting.

CREATING PROMISE

Syntax

```
const promise = new Promise((resolve, reject) => {
  // Asynchronous operation
  if (/* operation successful */) {
    resolve('Result of the operation');
  } else {
    reject('Error occurred');
  }
});
```

- `new Promise`: Constructor for creating a Promise.
- `resolve`: Function to fulfill Promise with value or another Promise.
- `reject`: Function to reject Promise with a reason (usually an Error).

USING PROMISE

Syntax

```
promise
  .then((result) => {
    // Handle the result of the Promise
    console.log(result);
  })
  .catch((error) => {
    // Handle the error if the Promise is rejected
    console.error(error);
  })
  .finally(() => {
    // Code to be executed regardless of the Promise's fate
  });
```

- `.then()`: Attach callbacks for Promise resolution.
- `.catch()`: Attach callback for Promise rejection.
- `.finally()`: Attach callback for Promise settlement (fulfilled or rejected).

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CHAINING PROMISES

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CHAINING PROMISES

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High-Level Explanation

- Chaining Promises: Sequentially connect promises.
- Each subsequent promise returned from `.then()` or `.catch()` of the previous one.
- Enables handling async tasks in a specific order.

Basic Explanation

- Analogy: Planning a day out with chained activities.
- Each activity as a Promise.
- Chained with `.then()` for sequential execution.

Best Practices

- Return results in `.then()` to keep the chain active.
- Handle errors with a final `.catch()` in the chain.
- Use `.finally()` for code running regardless of outcome.
- Avoid nesting Promises in `.then()`, return them.
- Split complex chains into smaller functions for readability.

Deep Dive

- Promise chaining: `.then()` handlers invoked sequentially.
- Value returned passed to the next `.then()`.
- New Promise from handler delays next `.then()`.
- Readable, maintainable async code, avoids callback hell.

When to use?

- Chaining Promises valuable for ordered async tasks.
- Useful for tasks dependent on previous outcomes.
- Common pattern for APIs, databases, async ops in JavaScript.

Summary

- Promise chaining: Execute async tasks sequentially.
- Each waits for the previous one to resolve.
- Enhances async code readability, maintainability.
- Ideal for task dependency scenarios.

CHAINING PROMISES

Syntax

```
firstPromise()
  .then((firstResult) => {
    // Handle the result of the first promise
    // Return a value or a new promise
    return secondPromise(firstResult);
  })
  .then((secondResult) => {
    // Handle the result of the second promise
    // Return a value or a new promise
    return thirdPromise(secondResult);
  })
  .catch((error) => {
    // Handle any error that occurred in any of the above promises
    console.error(error);
  })
  .finally(() => {
    // Execute some code, whether the promises were fulfilled or rejected
  });
```

- Placeholder function names: `firstPromise`, `secondPromise`, `thirdPromise`.
- `.then()`: Returns a Promise, handles success and failure.
- `.catch()`: Returns a Promise, handles chain rejection.
- `.finally()`: Returns a Promise, executes regardless of fulfillment or rejection.

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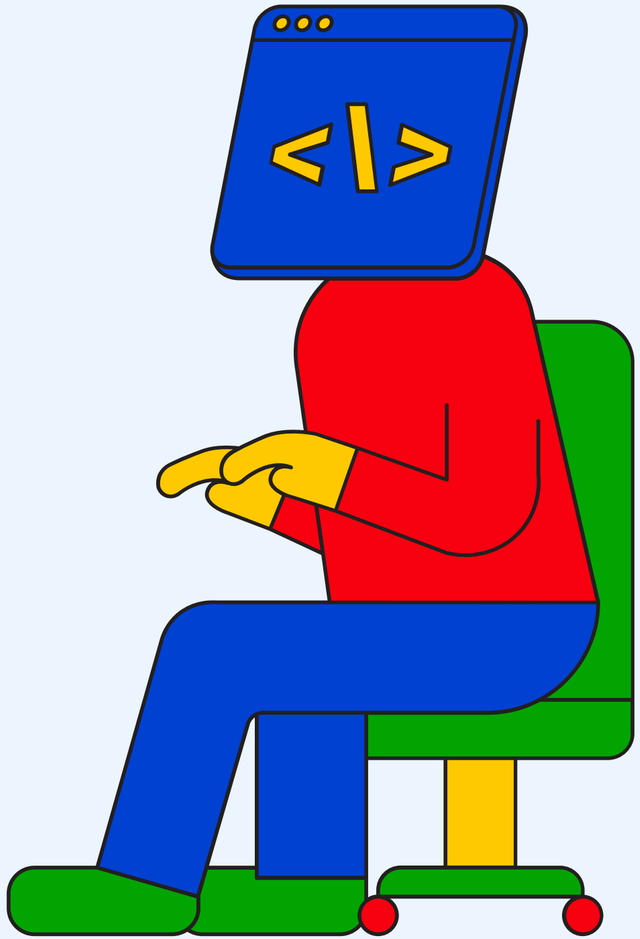
CODE DEMO



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ASYNCHRONOUS PROGRAMMING

Promise.all()
&
Promise.race()

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PROMISE.ALL AND PROMISE.RACE

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High-Level Explanation

- `Promise.all`: Wait for all Promises to resolve.
- `Promise.race`: Wait for the first Promise to resolve or reject.

Basic Explanation

- Analogy: `Promise.all` vs. `Promise.race`
- `Promise.all`: Waiting for friends to arrive at a meetup.
- `Promise.race`: Foot race, first to finish wins, others don't matter.

Best Practices

- `Promise.all`: Handle potential rejections to avoid overall rejection.
- `Promise.race`: Settles quickly but doesn't affect other pending Promises.

Deep Dive

-Promise.all:

- Takes an iterable of Promises.
- Returns a Promise that resolves when all input Promises resolve.
- Returns an array of resolved values in the same order as input.
- Rejects immediately if any input Promise rejects.

- **Promise.race:**
  - Takes an iterable of Promises.
  - Returns a Promise that settles as soon as one input Promise settles.
  - Value or reason from the first settled input Promise.

When to use?

-Promise.all: Use for multiple ops dependent on each other.

- Promise.race: Use for fastest result, e.g., timeouts, resource fetching.

Summary

- `Promise.all`: All Promises must resolve before proceeding.
- `Promise.race`: Any one Promise settling is sufficient.
- Use based on specific task requirements.

Syntax

`Promise.all

```
Promise.all(iterable)
  .then(resultArray => {
    // handle an array of results
  })
  .catch(error => {
    // handle an error
  });
```

- `iterable`: Collection of Promise objects.
- `resultArray`: Array with resolved values in input order.
- `.catch(error => {...})`: Handles rejections from any input Promise.

Syntax

`Promise.all

```
Promise.race(iterable)
  .then(firstResolvedValue => {
    // handle the value of the first resolved Promise
  })
  .catch(error => {
    // handle the error of the first rejected Promise
  });
```

- `iterable`: Collection of Promise objects.
- `firstResolvedValue`: Value from the first resolved Promise.
- `.catch(error => {...})`: Handles rejection from the first rejected Promise.

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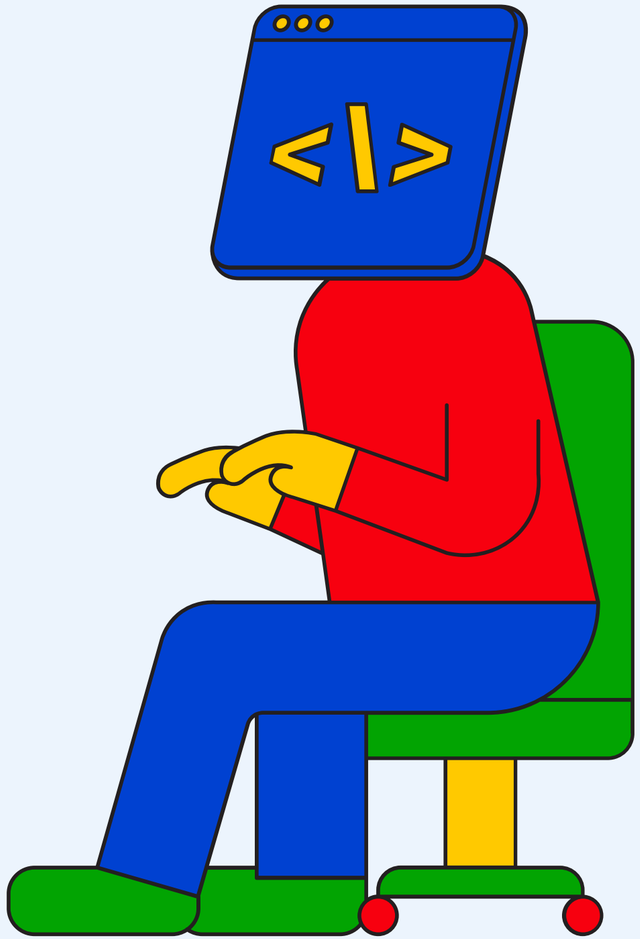
CODE DEMO



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ASYNCHRONOUS PROGRAMMING

ASYNC AWAIT

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INTRODUCTION TO ASYNC/AWAIT

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High-Level Explanation

- Modern for async operations.
- Based on Promises.
- `async` for async function.
- `await` pauses until Promise settles.
- Improves code readability, maintainability.

Basic Explanation

- Analogy: Async/Await like cooking
- Boiling pasta is async task
- Chopping veggies done concurrently
- Wait for pasta, do other tasks in coding

Best Practices

- Try/catch for error handling around `await`.
- Avoid `await` in loops for sequentiality.
- `Promise.all` for concurrent `await`.
- `await` inside `async` functions only.

Deep Dive

- Synchronous code runs line by line.
- Async needed for time-consuming tasks.
- Async/Await: Comfortable async code.
- `async` function returns Promise.
- `await` inside `async` for waiting on Promises.
- Code appears synchronous, acts async.
- Syntactic sugar over Promises.

When to use?

- Async/Await for multiple async tasks.
- Sequential or completion handling.
- Examples: API calls, file I/O, database ops.

Summary

- Clean, readable async code in JavaScript.
- Builds on Promises, handles tasks sequentially.
- Simplifies error handling.
- Use for async ops, follow best practices.
- Maintain neat, maintainable code.

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Syntax

async` Function

```
async function functionName() {
  // return promise
}
```

- `async`: Identifies function as asynchronous.
- `functionName()`: Name of the async function.

`await` Expression

```
let result = await functionName();
```

- `let result`: Variable for storing resolved Promise value.
- `await`: Waits for Promise settlement.
- `functionName()`: A Promise-returning function, e.g., API fetch.

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Syntax

async` Function

```
try {
  let result = await someAsyncFunction();
  // Handle result
} catch (error) {
  // Handle error
}
```

- `try`: Contains async operations.
- `catch (error)`: Handles errors from `try` block.- `functionName()`: Name of the async function.

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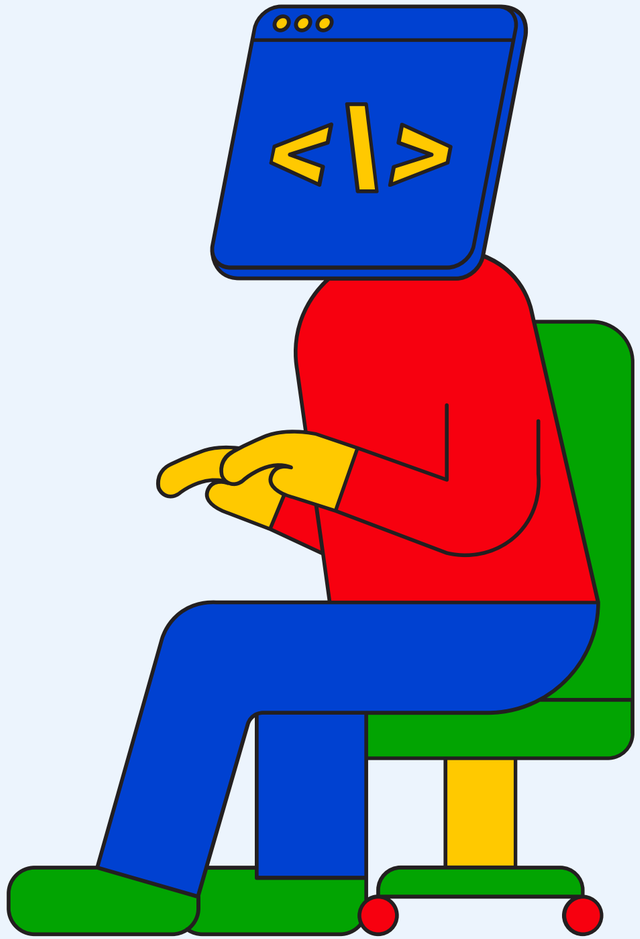
CODE DEMO



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ASYNCHRONOUS PROGRAMMING

ASYNC AWAIT ERROR HANDLING

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ERROR HANDLING WITH ASYNC/AWAIT

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High-Level Explanation

- Error handling in Async/Await: Vital for graceful async ops
- Use `try-catch` in `async` functions
- Capture and handle errors to prevent crashes, issues

Basic Explanation

- Analogy: Vending machine behavior like error handling
- Payment failure doesn't freeze or confuse.
- Machine informs about error, suggests actions.
- User-friendly behavior mirrors Async/Await error handling.

Best Practices

- Wrap `await` in `try-catch`.
- Specify error messages for debugging, user feedback.
- Avoid mixing Promise and Async/Await error handling.
- Handle errors; don't ignore, consider logging.
- Use `finally` for cleanup, regardless of async outcome.

Deep Dive

- Asynchronous programming can lead to various issues.
- API downtimes, network failures, data format errors can cause problems.
- Unhandled promise rejections can crash or destabilize apps.
- Using `try-catch` with Async/Await:
  - Traps errors
  - Manages errors effectively
  - Offers alternative flows, user messages
- Enhances code robustness, ensures consistent user experience.

When to use?

- Error handling in Async/Await crucial for:
  - API requests (server down, incorrect data)
  - Reading files (nonexistent, permission issues)
  - User input (unexpected format, out-of-range)

Summary

- Async/Await error handling ensures graceful async issue management.
- `try-catch` in `async` functions creates robust apps.
- Consistent, user-friendly experiences in error scenarios.
- Error handling isn't just capturing; it guides flow, informs users.

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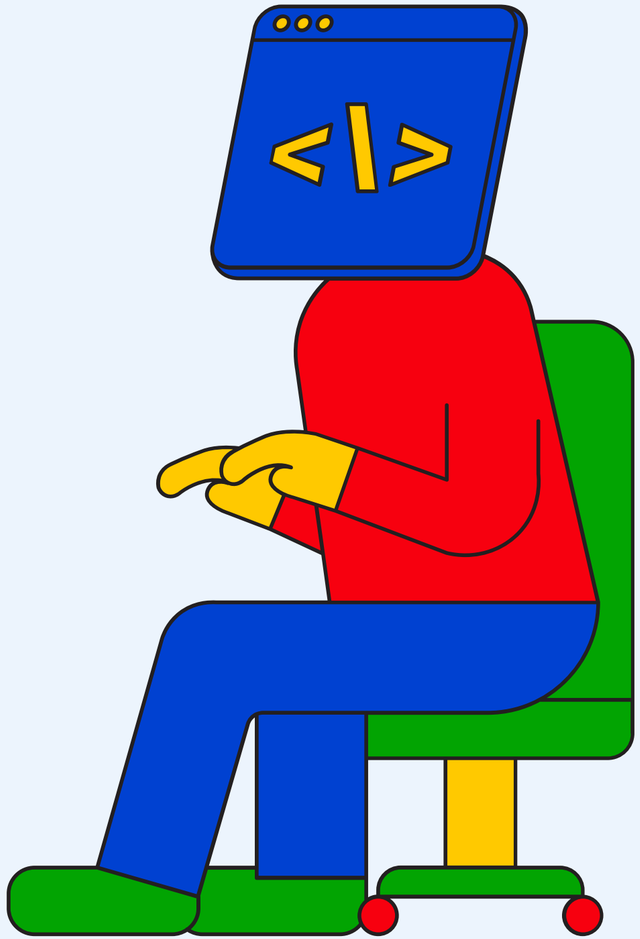
CODE DEMO



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ASYNCHRONOUS PROGRAMMING

MAKING HTTP REQUEST AJAX

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ASYNCHRONOUS PROGRAMMING

AJAX

OVERVIEW

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AJAX OVERVIEW

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High-Level Explanation

- Ajax: Asynchronous JavaScript and XML
- Technique for dynamic, interactive web apps
- Send/receive data from server without full page reload

Deep Dive

- Traditional pages required full reload for new content.
- Ajax revolutionized by enabling partial data exchange.
- Components: XHR, JavaScript, HTML/CSS for data presentation.
- Data Formats: JSON now more popular than XML for interchange.

Basic Explanation

- Analogy: Ajax as a messenger
- Avoiding your (webpage) trips to the main office (server)
- The messenger (Ajax) fetches data, delivers it, and you continue working

When to use?

- Dynamic loading (e.g., infinite scrolling).
- Form submissions without page reload.
- Periodic updates (e.g., live sports scores).
- Fetching product details without refreshing.

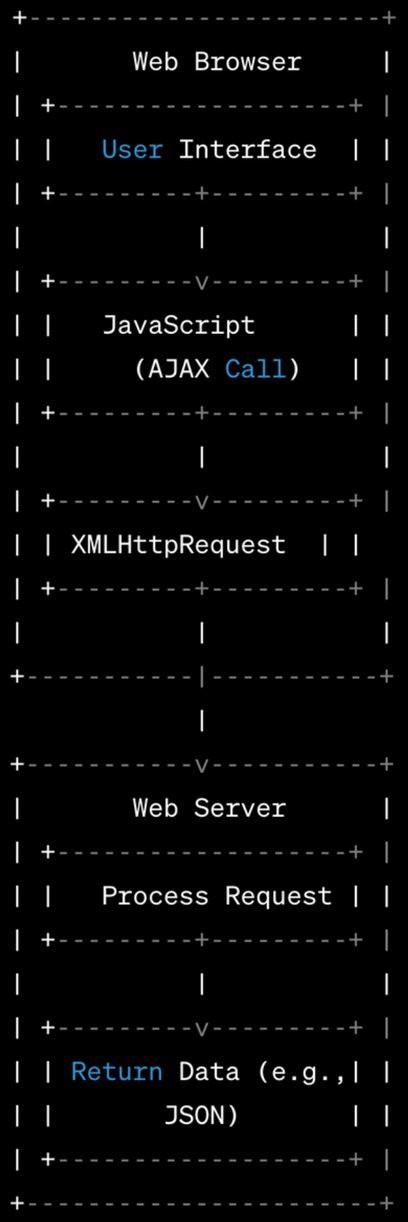
Best Practices

- Handle potential errors in requests.
- Give user feedback (e.g., loading spinner).
- Limit request frequency for performance.
- Prefer JSON for ease and efficiency.

Summary

- Ajax: Fetch/send data without full page reload.
- Uses XMLHttpRequest, often works with JSON.
- Vital for dynamic, responsive web apps.
- Best practices enhance user experience and interaction.

AJAX OVERVIEW



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ASYNCHRONOUS PROGRAMMING

MAKING HTTP REQUEST

XMLHTTPREQUEST

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MAKING HTTP REQUESTS WITH XMLHTTPREQUEST

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High-Level Explanation

- XMLHttpRequest (XHR): Browser object for HTTP requests.
- Key for AJAX, fetch data without full page refresh.
- Send/receive HTTP requests and responses.

Basic Explanation

- Analogy: XMLHttpRequest is like texting a friend.
- No need to restart (refresh) the whole site.
- Just "text" the server for info or data exchange.

Best Practices

- Handle potential errors gracefully.
- Use `readystatechange` event to track request state.
- Avoid synchronous requests; prefer asynchronous.
- Consider modern alternatives like Fetch or Axios.

Deep Dive

- XMLHttpRequest introduced in the early 2000s.
- Revolutionary, made web dynamic and responsive.
- Process involves object creation, config, event listeners, sending.
- Data received in various formats: text, JSON, XML, etc.

When to use?

- Fetching data post-page load (e.g., feed updates).
- Sending form data without page reload.
- Polling: regular server data checks.

Summary

- XMLHttpRequest: Allows web apps to communicate with servers.
- Key player in AJAX revolution for dynamic web.
- Dated but important for web dev history.
- Coexists with modern alternatives like Fetch API.

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Syntax

```
// Step 1: Create a new instance of XMLHttpRequest
let xhr = new XMLHttpRequest();

// Step 2: Configure the request
xhr.open('GET', 'https://api.example.com/data', true);

// Step 3: Attach event listeners
xhr.onreadystatechange = function() {
  if (xhr.readyState === 4 && xhr.status === 200) {
    // Handle the response here
    let response = JSON.parse(xhr.responseText);
  }
};

// Step 4: Send the request
xhr.send();
```

1. Initialize XMLHttpRequest with `let xhr = new XMLHttpRequest();`.
2. Configure request details with `xhr.open()`.
3. Set up an event listener for state changes with `xhr.onreadystatechange`.
4. Check if the request is complete and successful.
5. Parse JSON response with `JSON.parse(xhr.responseText)`.
6. Send the request with `xhr.send()`.

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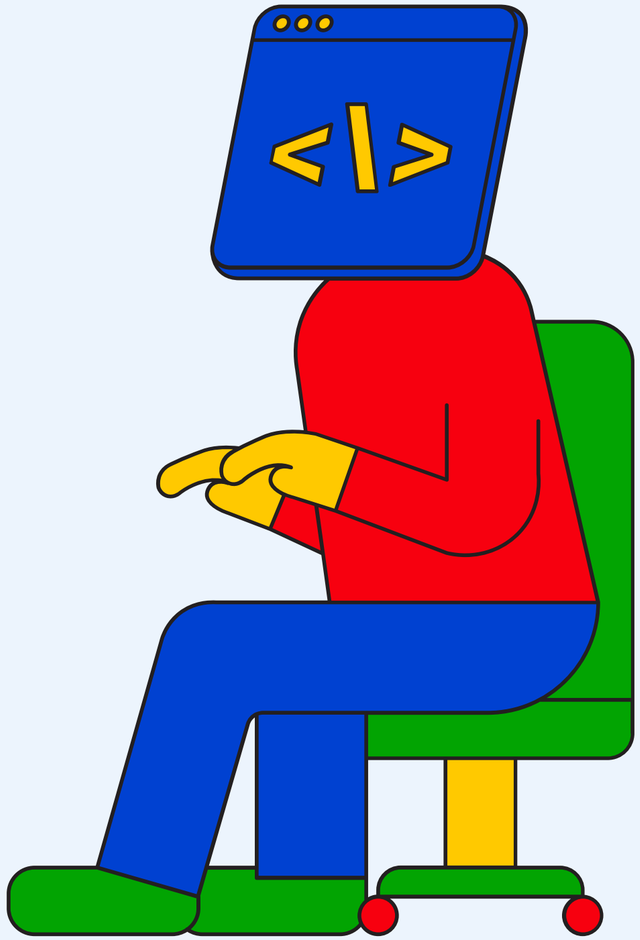
CODE DEMO



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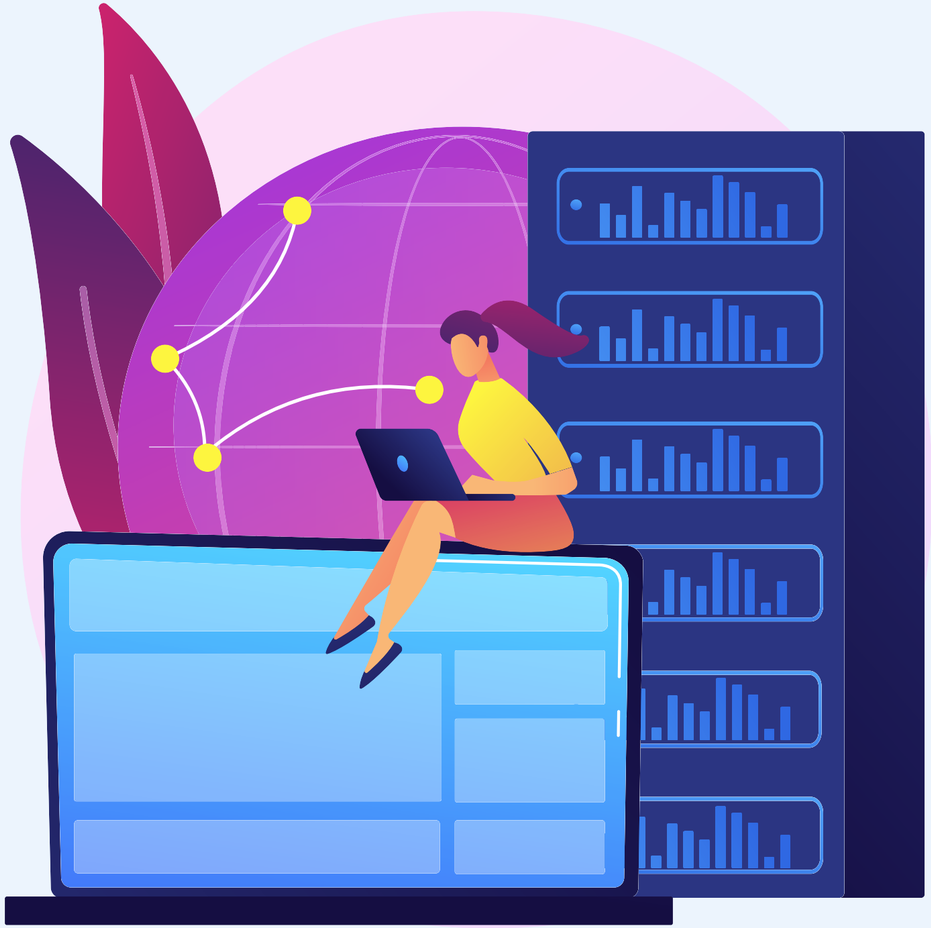
ASYNCHRONOUS PROGRAMMING

MAKING HTTP REQUEST FETCH API



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MAKING HTTP REQUESTS WITH THE FETCH API

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High-Level Explanation

- Fetch API: Modern alternative to XMLHttpRequest.
- Uses Promises for readability and manageability.
- Native to JavaScript, widely supported in modern browsers.

Basic Explanation

- Analogy: Fetch is like ordering a pizza online.
- Hitting "Order" is like using Fetch in JavaScript.
- You request data, get a promise, and use it once it arrives.

Best Practices

- Handle errors with `.catch()` or `try/catch`.
- Customize requests with options object.
- Check `ok` property for request success.
- Be mindful of CORS for cross-origin requests.

Deep Dive

- Fetch API introduced in ECMAScript 2015 (ES6).
- Cleaner and more powerful network requests.
- Promise-based for asynchronous handling.
- Compatible with `async/await` for synchronous-like code.

When to use?

- Fetching data in modern web apps.
- API calls in single-page apps (SPA).
- CRUD operations, managing requests and responses.

Summary

- Fetch API: Modern, promise-based network requests.
- Cleaner and more powerful than XMLHttpRequest.
- Widely used in modern web development.

Syntax

```
fetch('https://api.example.com/data')
  .then(response => response.json())
  .then(data => console.log(data))
  .catch(error => console.error('Error:', error));
```

With Async Await

```
async function fetchData() {
  try {
    const response = await fetch('https://api.example.com/data');
    const data = await response.json();
    console.log(data);
  } catch (error) {
    console.error('Error:', error);
  }
}

fetchData();
```

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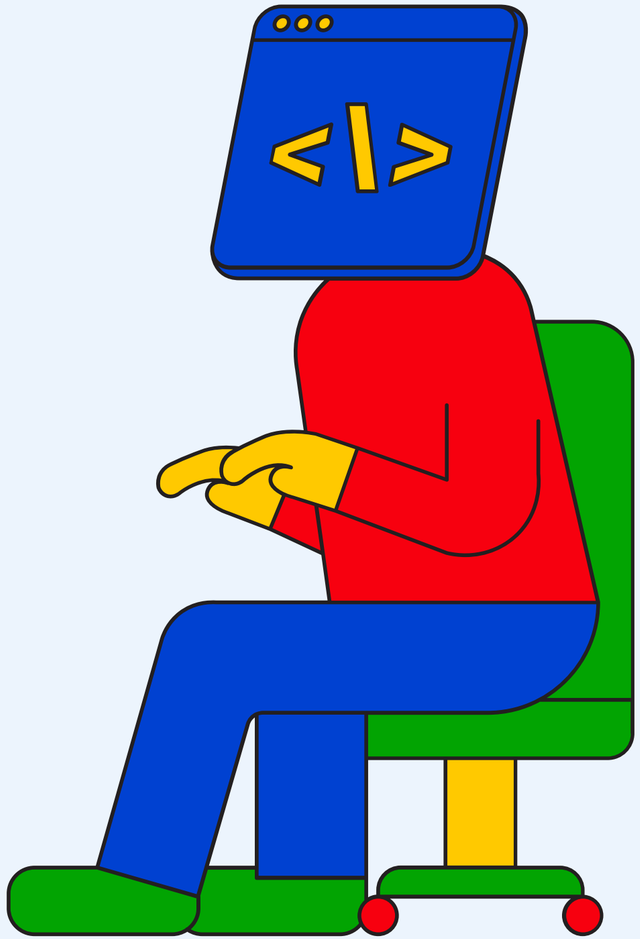
CODE DEMO



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ASYNCHRONOUS PROGRAMMING

MAKING HTTP REQUEST AXIOS CLIENT

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MAKING HTTP REQUESTS WITH THE AXIOS API

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High-Level Explanation

- Axios: JavaScript library for HTTP requests.
- Must be installed separately.
- Promises-based, offers cleaner, powerful client-server communication API.

Deep Dive

- Axios: Popular in front-end and back-end development.
- Offers extensive features: request/response intercepting, data transformation, error handling.
- Works seamlessly in Node.js, versatile for various JavaScript environments.

Basic Explanation

- Analogy: Axios as a super-smart remote control.
- Controls multiple aspects, versatile.
- Easy to use, works everywhere, advanced settings.
- Axios for web developers, communicates with servers, packed with features.

When to use?

- For HTTP requests in both browser and Node.js.
- When advanced features like request cancellation or transformation are needed.
- To create cleaner asynchronous code with a promise-based API.

Best Practices

- Handle errors with `catch` or `try/catch`.
- Employ interceptors for central request/response handling.
- Import Axios from trusted sources.
- Leverage Axios instances for reusable configurations.

Summary

- Axios: Powerful promise-based HTTP client.
- Works across environments, flexible.
- Advanced features for efficient, manageable communication.

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Syntax

```
axios.get('https://api.example.com/data')
  .then(response => {
    // handle response
  })
  .catch(error => {
    // handle error
  });
```

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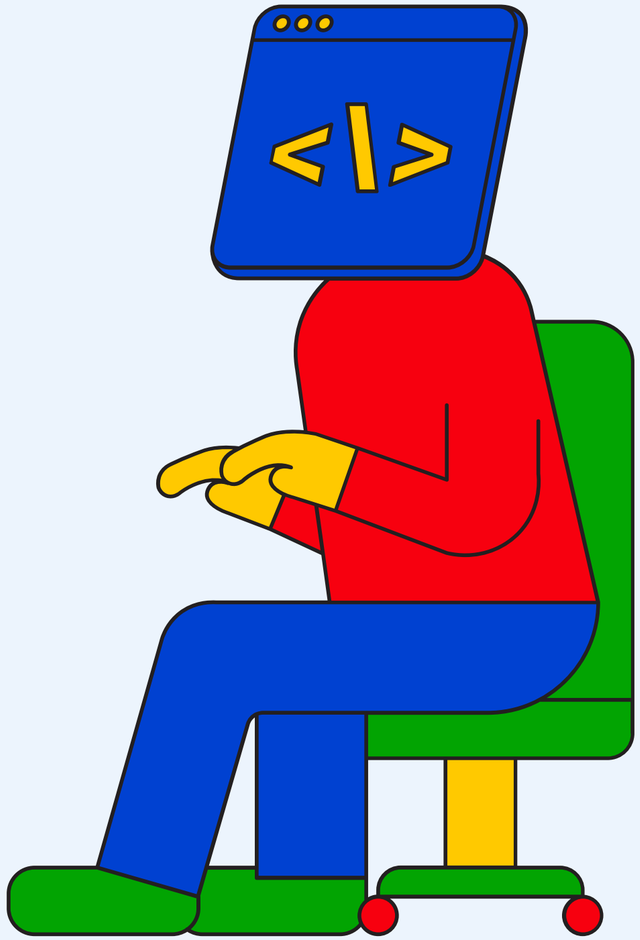
CODE DEMO



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