

Async and Defer Attributes in HTML

The `async` and `defer` attributes are used with the `<script>` tag in HTML to control how JavaScript files are loaded and executed. These attributes are essential for optimizing page load performance, especially when dealing with external scripts.

1. Async Attribute

Purpose: The `async` attribute allows the browser to download the script file in the background without blocking the parsing of the HTML document. Once the script is downloaded, it is executed immediately, even if the HTML parsing is not complete.

Key Characteristics:

- The script is downloaded asynchronously (in parallel with HTML parsing).
- Once the script is downloaded, it is executed immediately.
- The execution order of scripts with `async` is not guaranteed if multiple scripts are present.

Use Case: Use `async` when the script is independent of other scripts on the page, and you want to speed up the page load by loading the script in parallel.

Example:

```
<script src="script1.js" async></script>
```

```
<script src="script2.js" async></script>
```

2. Defer Attribute

Purpose: The `defer` attribute also allows the browser to download the script in the background

without blocking HTML parsing. However, unlike async, the script is executed only after the entire HTML document has been parsed.

Key Characteristics:

- The script is downloaded asynchronously (in parallel with HTML parsing).
- The script is executed after the HTML document is fully parsed.
- The execution order of scripts with defer is maintained, meaning they will run in the order they appear in the HTML.

Use Case: Use defer when the script is dependent on the DOM being fully parsed or when you need to ensure that multiple scripts execute in a specific order.

Example:

```
<script src="script1.js" defer></script>
<script src="script2.js" defer></script>
```

Summary of Differences

Attribute	Script Loading	Script Execution	Order of Execution
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async	Asynchronously	As soon as downloaded	Not guaranteed (no order)
defer	Asynchronously	After HTML parsing is complete	Guaranteed (in order)

When to Use Which

- async is suitable for scripts that are independent and do not rely on other scripts or the DOM. For example, analytics scripts or third-party widgets that can execute as soon as they're ready.

- defer is ideal for scripts that need to interact with the DOM or rely on other scripts. It ensures that the scripts run in the order you expect, after the HTML is fully parsed.

Note: Both async and defer are ignored for inline scripts. They are only applicable to external scripts loaded via the src attribute.