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2024

JavaScript Modules

“The” language of the Web

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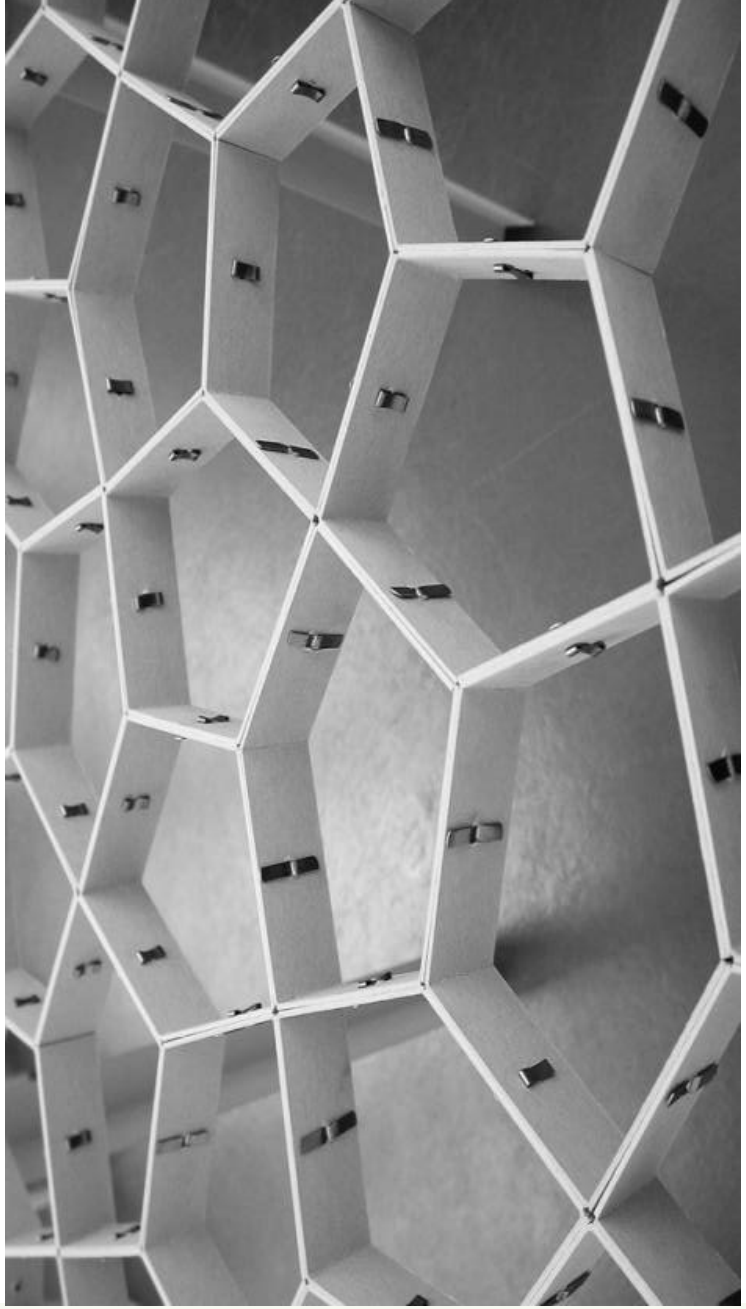


JavaScript: The Definitive Guide, 7th Edition
Chapter 10. Modules

Mozilla Developer Network

- Web technology for developers » JavaScript » JavaScript Guide » JavaScript Modules

Modular JS programming

MODULES

Modules

- Mechanisms for splitting JavaScript programs into separate files that can be imported when needed
- Encapsulate or hide private implementation details and keep the global namespace tidy so that modules can not accidentally modify the variables, functions and classes defined by other modules
- 3 kinds of modules ⟹

1. *Do-It-Yourself* (with classes, objects, IIFE and closures)
2. **ES6 modules** (using `export` and `import`)
   1. ECMA Standard
   2. Supported by recent browsers
   3. Supported by Node (v13+)
3. Node.js modules (using `require()`) – called **CommonJS**
   1. Based on closures
   2. Never standardized by ECMA, but the normal practice with Node

ES6

CJS

ES6 Modules

ES6

- A module is a JavaScript file that **exports** one or more values (objects, functions or variables), using the `export` keyword
  - each module is a piece of code that is executed once it is loaded
- Any other JavaScript module can **import** the functionality offered by another module by importing it, with the `import` keyword
- Imports and exports must be at the *top level*
- Two main kinds of exports:
  - **named** exports (several per module)
  - **default** exports (one per module)

Default Export

ES6

- Modules that only export **single values**
  - Only one per module
  - You are exporting a values, but not the name of the resource
- Syntax
  - `export default <value>`

```
export default str =>
str.toUpperCase();

// OTHER examples
export default {x: 5, y: 6};

export default "name";

function grades(student) {...};
export default grades;
```

Named Exports

ES6

- Modules that export **one or more values**
  - several per module
  - Exports also the names
- Syntax
  - `export <value>`
  - `export {<value>, <...>}`

```
export const name = 'Luigi';

function grades(student) {...};
export grades;

const name = 'Luigi';
const anotherName = 'Fulvio';
export { name, anotherName }
// we can also rename them...
// export {name, anotherName as teacher}
```

Imports

ES6

- To import something exported by another module
- Syntax
  - `import package from 'module-name'`
- Imports are:
  - hoisted
  - read-only views on exports

Import From a **Default** Export

ES6

```
//--- module1.js ---
export default str =>
str.toUpperCase();
```

```
//--- module2.js ---
import toUpperCase from './module1.js';
// you choose the name!

// another example
import uppercase from '/home/app/module1.js';

// usage of the imported function
uppercase('test');
```

Import From a Named Export

ES6

```
//--- module1.js ---
const name = 'Luigi';
const anotherName = 'Fulvio';

export { name, anotherName };
```

```
//--- module2.js ---
import { name, anotherName } from './module1.js';

// you can rename imported values, if you want
import { name as first, anotherName as second}
      from './module1.js';

// usage
console.log(first);
```

Other Imports Options

ES6

- You can import everything a module exports
  - `import * from 'module'`
- You can import a few of the exports (e.g., if `export {a, b, c}`):
  - `import {a} from 'module'`
- You can import the default export alongside with any named exports:
  - `import default, { name } from 'module'`

ES6 Modules In The Browser

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide/Modules

https://v8.dev/features/modules

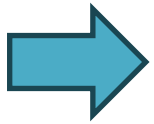
ES6

- File extension
  - Preferred: `.mjs` (ensure the server sets `Content-Type: text/javascript`)
  - Also accepted: `.js`
- Load in HTML
  - `<script type="module" src="main.js"></script>`
  - Only load the "main" modules, others will be loaded by `import` statements
  - **Only files loaded with `type="module"` may use `import` and `export`**
  - Modules are **automatically** loaded in **`defer`** mode
  - Note: locally loading modules (`file:///`) does not work due to CORS

ES6 Modules In Node.js

ES6

- Node.js started to support ES6 modules only recently
- From Node.js v14 (LTS)
  - Enabled by default
  - Must use a file extension of .mjs *or* specify `"type": "module"` in package.json
  - https://nodejs.org/docs/latest-v20.x/api/esm.html#enabling
- **Beware**: not all Node.js modules are provided as ES6 modules



In Node.js, use CommonJS modules with `require()`

CommonJS Modules

CJS

- The standard module format in Node.js
- Uses the `.js` or `.cjs` extension
- Not natively supported by browsers
  - Unless you use libraries such as RequireJS (https://requirejs.org/)
- It is basically a wrapper around your module code

```
(function(exports, require, module, __filename, __dirname) {
// Module code actually lives in here
});
```

https://nodejs.org/docs/latest-v20.x/api/modules.html

CommonJS Imports

CJS

- To import something exported by another module
- `const package = require('module-name')`
  - Looked up in node_modules
- `const myLocalModule = require('./path/myLocalModule');`
  - Looked up in a relative path from __dirname or $cwd

CommonJS Exports

CJS

- Assign your exported variables by creating new properties in the object `module.exports` (shortcut: `exports`)
- Examples:
  - `exports.area = (r) => Math.PI*(r**2);`
  - ```
    module.exports = class Square {
      constructor(width) {
        this.width = width;
      }
      area() {
        return this.width ** 2;
      }
    };
    ```

```
'use strict';

/* Data Access Object (DAO) */
const db = require('./db');
const dayjs = require("dayjs");

// Retrieves the whole list of films
exports.listFilms = (filter) => {
  return new Promise((res, rej) => {
    const sql = 'SELECT * FROM films';
    db.all(sql, (err, rows) => { …
    …
}}}
```
```

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