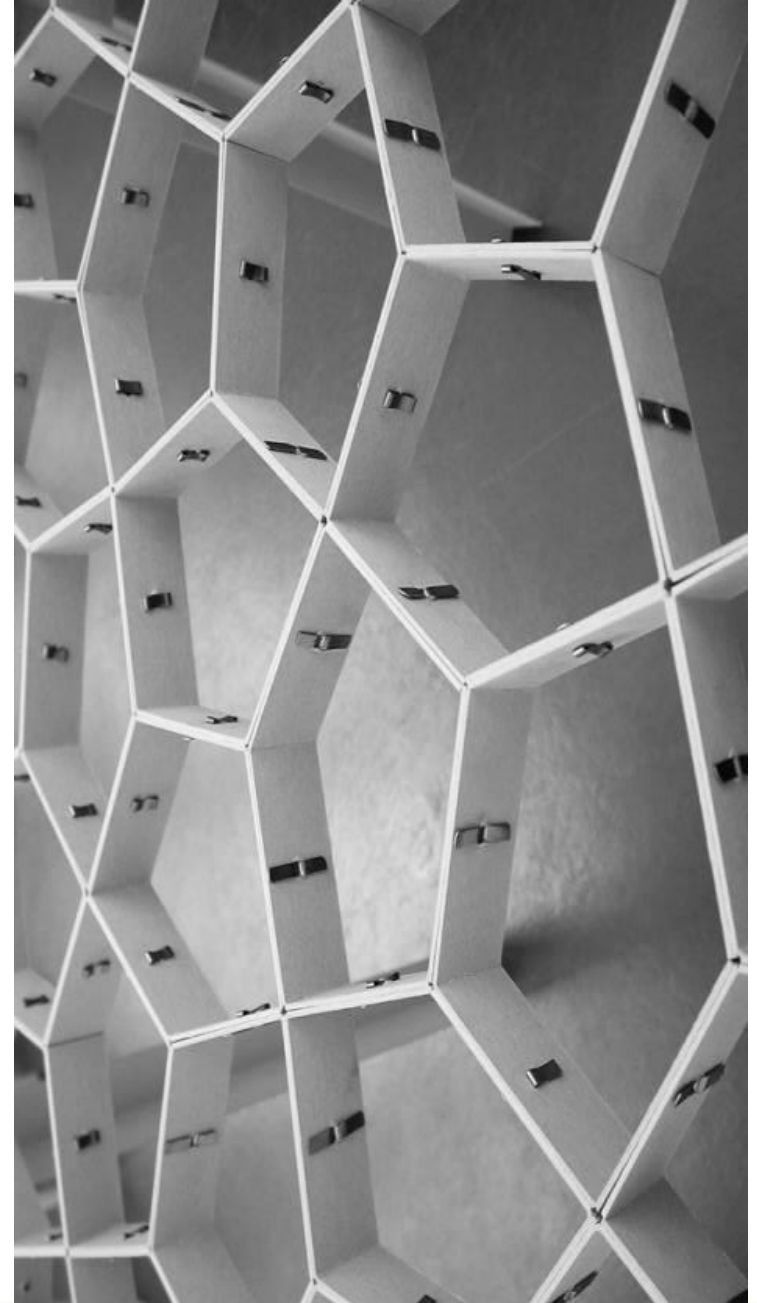# JavaScript Modules

"The" language of the Web

Fulvio Corno

Luigi De Russis

Enrico Masala

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 <u>separate files</u> that can be imported when needed
- <u>Encapsulate or hide private implementation</u> 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" $\implies$

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

ES6 Modules

- 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 <u>must</u> be at the *top level*
- Two main kinds of exports:
  - **named** exports (several per module)
  - **default** export (one per module)

Default Export

- Modules that only export **single values**
  - <u>Only one</u> per module
  - You are exporting a values, but not the name of the resource
    - But it can be an object… (though it can be imported only as an object, use named exports for other cases)

- 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

- Modules that export **one or more values**
  - <u>several</u> 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

- 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

```
//--- module1.mjs ---

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

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

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

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

Import From a Named Export

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

export { name, anotherName };
```

```
//--- module2.js ---
// Here {} works with named exports, not objects
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);
```
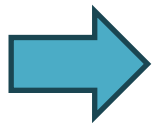
Other Imports Options

- 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

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), in 2020
  - Enabled by default
  - **Must use a file extension of .mjs** *or* specify `"type": "module"` in package.json
  - Note: .mjs files are automatically executed in **strict mode**
  - https://nodejs.org/docs/latest-v20.x/api/esm.html#enabling
- **Beware**: not all Node.js modules are provided as ES6 modules
  - Nowadays, almost all major packages are available as ES6 modules

For this course:
in Node.js, use ES6 modules with `.mjs` file extension

CommonJS Modules

- Used to be 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

- 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

- 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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