How writing just one import the wrong way slows down your website

François Martin

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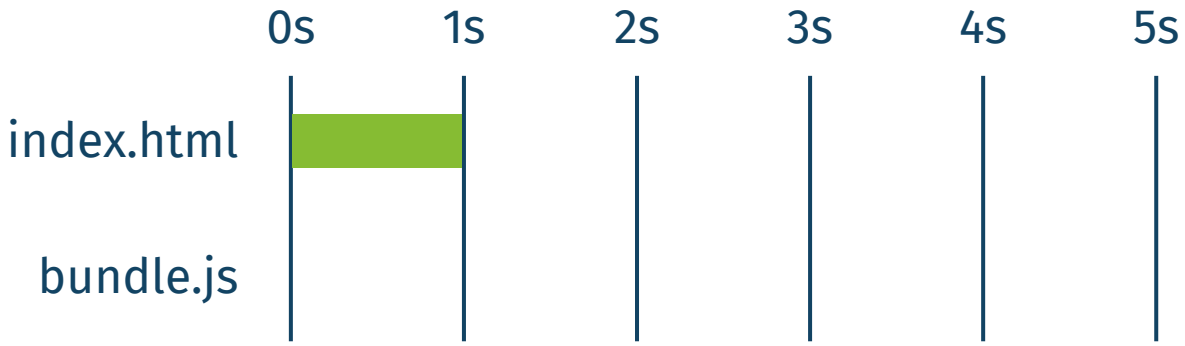
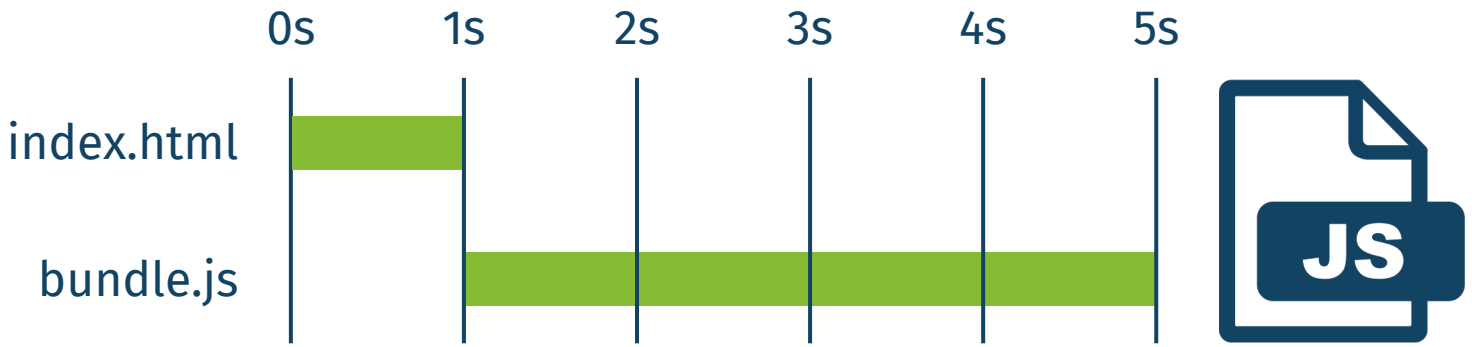
Bundle Size

```
"dependencies": {
  "react": "17.0.1",
  "react-dom": "17.0.1",
}
```



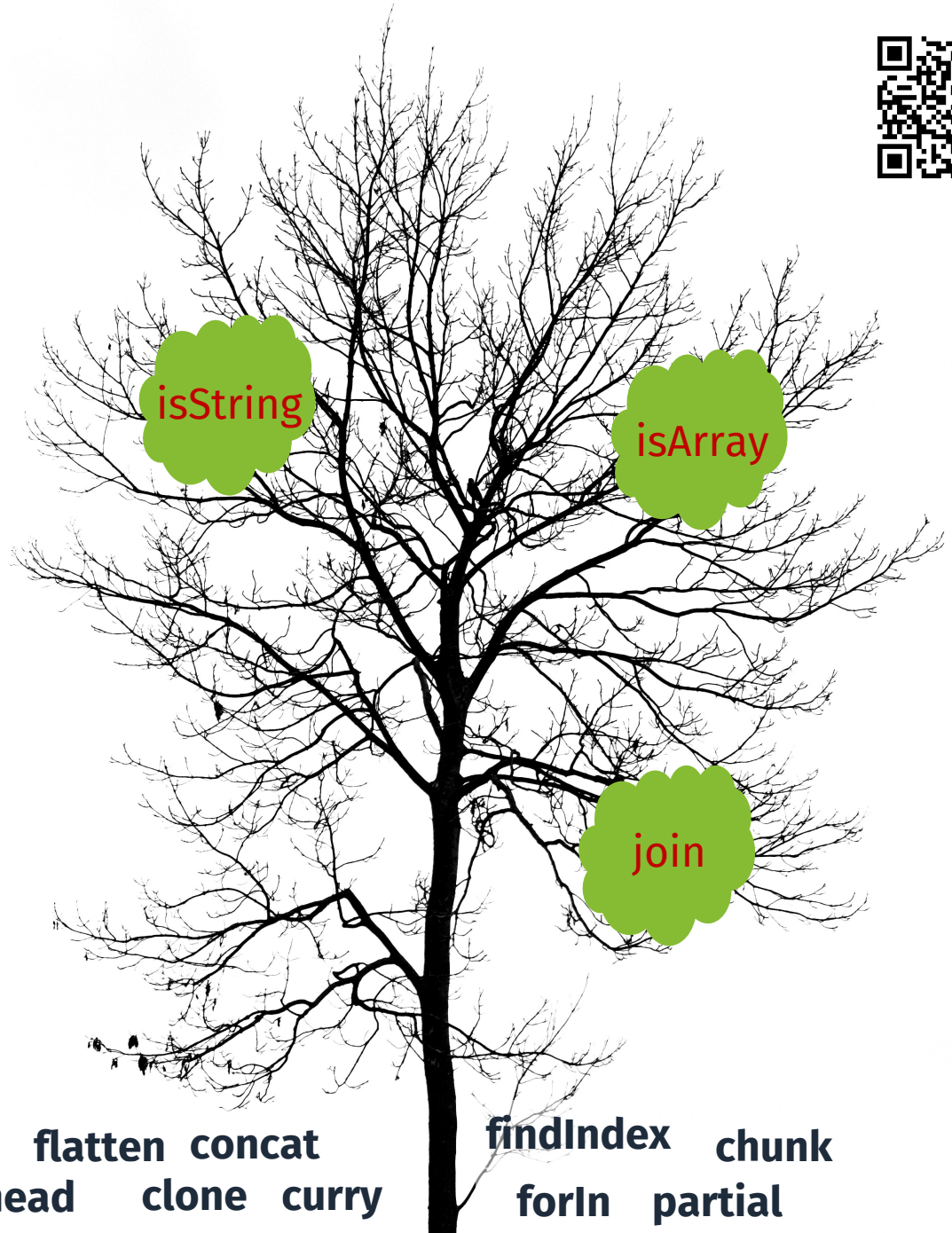

```
"dependencies": {
  "react": "17.0.1",
  "react-dom": "17.0.1",
  "lodash": "4.17.20",
  "@material-ui/core": "4.11.0",
  "@material-ui/icons": "4.9.1",
  "@material-ui/styles": "4.10.0",
  "chartjs": "2.9.4",
  "moment": "2.29.1",
  "reactstrap": "8.7.1",
  "the-whole-internet": "1.0.0"
}
```



Example

```
import isString from "lodash/isString";
import isArray from "lodash/isArray";
import join from "lodash/join";

function shakeIt(input) {
  if (isString(input)) {
    return input;
  } else if (isArray(input)) {
    return join(input, "-");
  } else {
    return input.toString();
  }
}
```



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Let‘s start with the basics…

Terminology: Bundler, Bundle (simplified)

package.json:

```
{
  "name": "hello-react",
  "dependencies": {
    "react": "17.0.1",
    "react-dom": "17.0.1",
    "lodash": "4.17.20"
  },
  "devDependencies": {
    "webpack": "5.4.0"
  }
}
```

Bundler

index.html

bundle.js


```
<!doctype html>
<html lang="en">
  <body>
    <script src="bundle.js"></script>
  </body>
</html>
```

Source Code + Dependencies

Definition

- **Dead-code elimination**
- Relies on static structure of ES2015 module syntax (**import**, **export**)
- Name and concept popularized by bundler **rollup**.

Rich Harris Follow
Dec 22, 2015 · 3 min read

I've been working (albeit sporadically of late, admittedly) on a tool called Rollup, which bundles together JavaScript modules. One of its features is *tree-shaking*, by which I mean that it only includes the bits of code your bundle actually needs to run.

- Supported by rollup since 2015
- Supported by webpack since version 2 (2016)

Adding lodash, good idea?

BUNDLEPHOBIA

lodash@4.17.21

BUNDLE SIZE

69.8 kB MINIFIED

24.4 kB MINIFIED + GZIPPED

DOWNLOAD TIME

488 ms SLOW 3G

28 ms EMERGING 4G

Over half the size of vue!

Yes, if done correctly, will be tree-shaken!

BUNDLEPHOBIA

vue@3.4.27

tree-shakeable

BUNDLE SIZE

112.7 kB MINIFIED

40.7 kB MINIFIED + GZIPPED

DOWNLOAD TIME

0.81 s SLOW 3G

47 ms EMERGING 4G

How to use Tree Shaking?

Most of the advice on tree shaking online: **Use ES2015 style imports / exports**

Exports:

❌
```
function foo() {...};
module.exports = foo;
```

✅
```
export function foo() {...};
```

Imports:

❌
```
const foo = require('./foo');
```

❌
```
import foo from './foo';
```

✅
```
import { foo } from './foo';
```

NEVER do this!

❌
```
import lodash from 'lodash';
```

Will include EVERYTHING from lodash in your bundle!

Impact on Bundle Size

How much does `isString` from lodash increase the bundle size?

```
import { isString } from 'lodash';
```

Bundle size before: 196.924 KB

Bundle size after: 220.844 KB **(+23.92 KB)**

Wait a second...

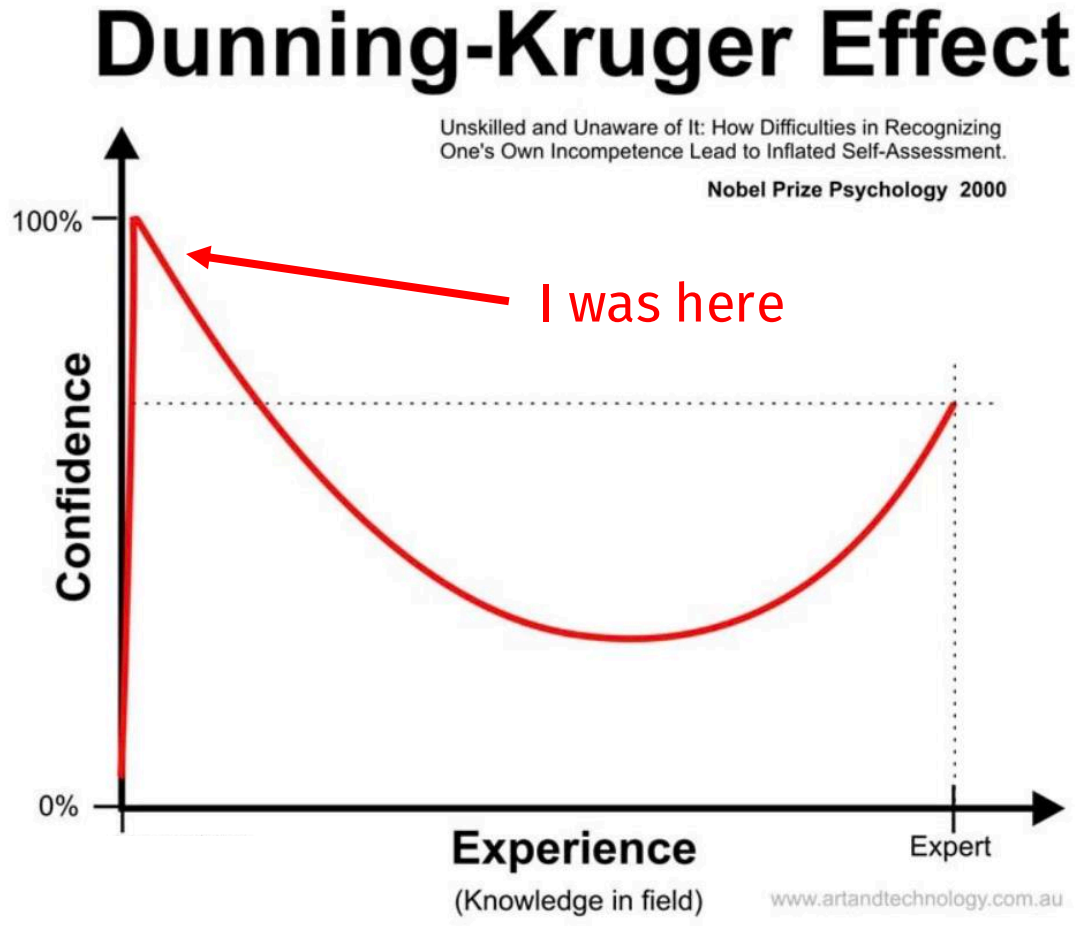
What??? It just added the entire lodash to the bundle?

BUNDLEPHOBIA

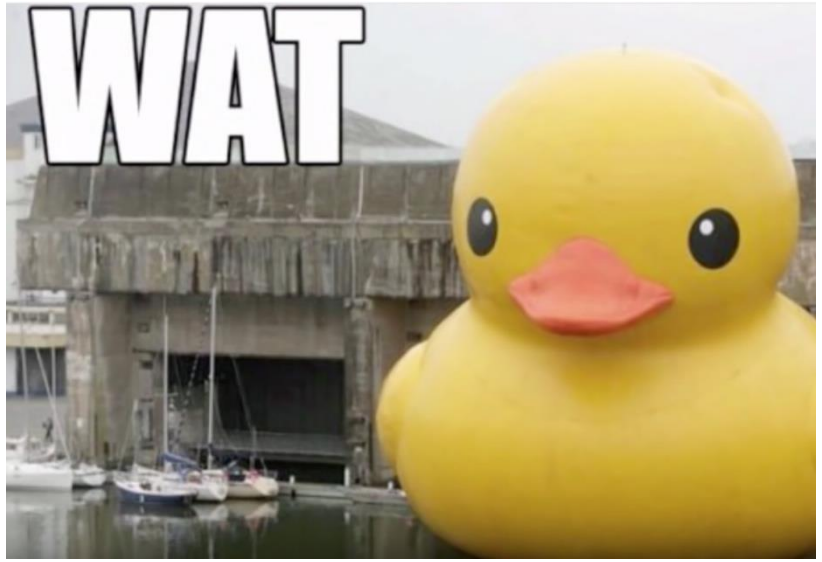
BUNDLE SIZE

24.4 kB

MINIFIED + GZIPPED



What the internet doesn‘t tell you



… about Tree Shaking

- Looking at the implementation of lodash‘s `isString`:

```
function isString(value) {
  return typeof value == 'string' || ...;
}
module.exports = isString;
```

- Turns out, when using ES2015 imports together with CommonJS exports, it results in **importing the whole module instead**
  - No warnings by the IDE!
  - No warnings by the linter!
  - No warnings by the bundler!

How to use Tree Shaking here?

❌ Copy the implementation of `isString` from lodash into your codebase.

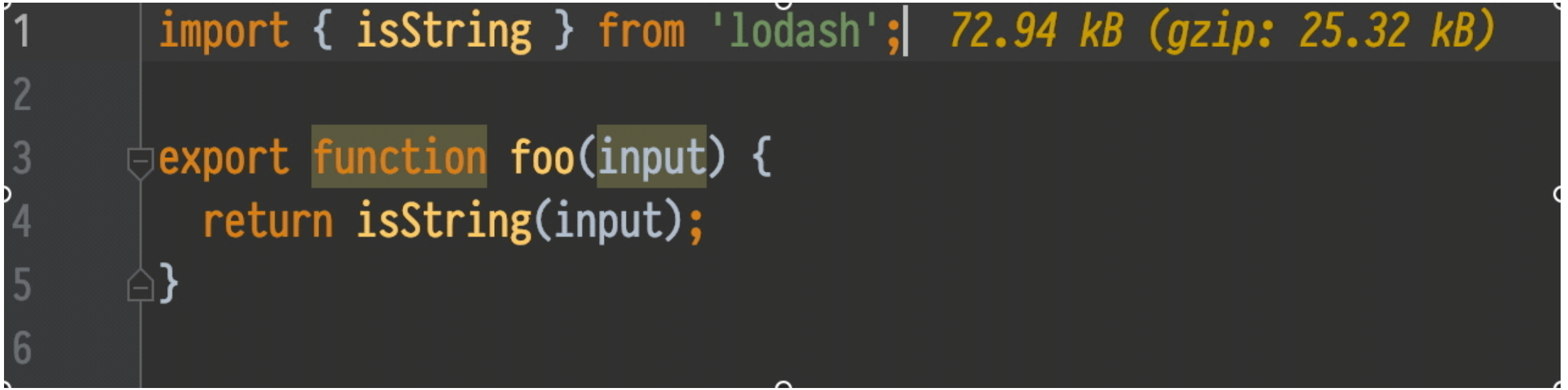
- lodash is structured in a way that uses one js file per method (*cherry-picking syntax*):
  ```
  import isString from 'lodash/isString';      (+0.21 KB)
  ```

- lodash offers package with ES2015 style imports called lodash-es:
  ```
  import { isString } from 'lodash-es';        (+0.22 KB)
  ```

But there must be an easier way!

There is (at least kind of…)

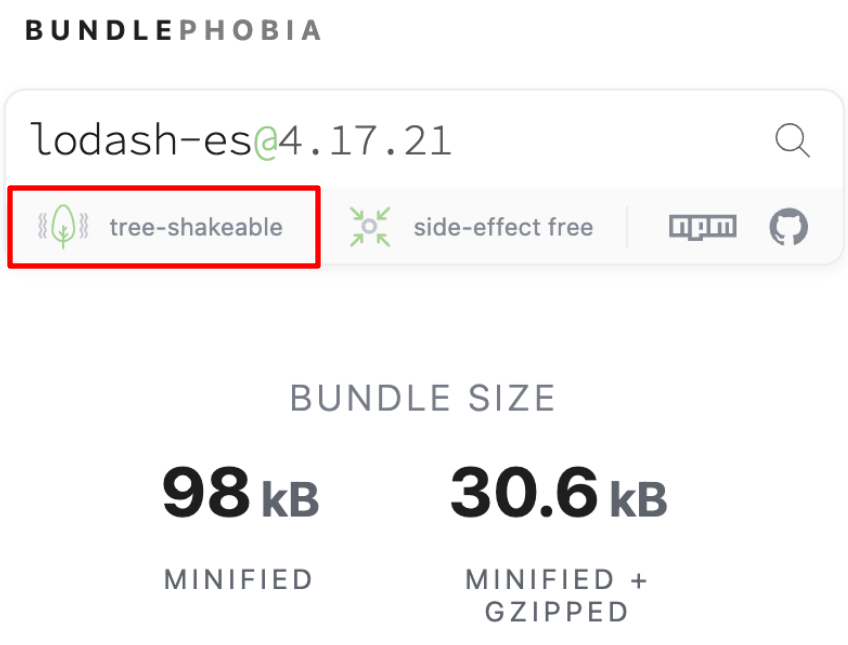
Import Cost plugin for IntelliJ and VSCode estimates bundle size impact for imports:

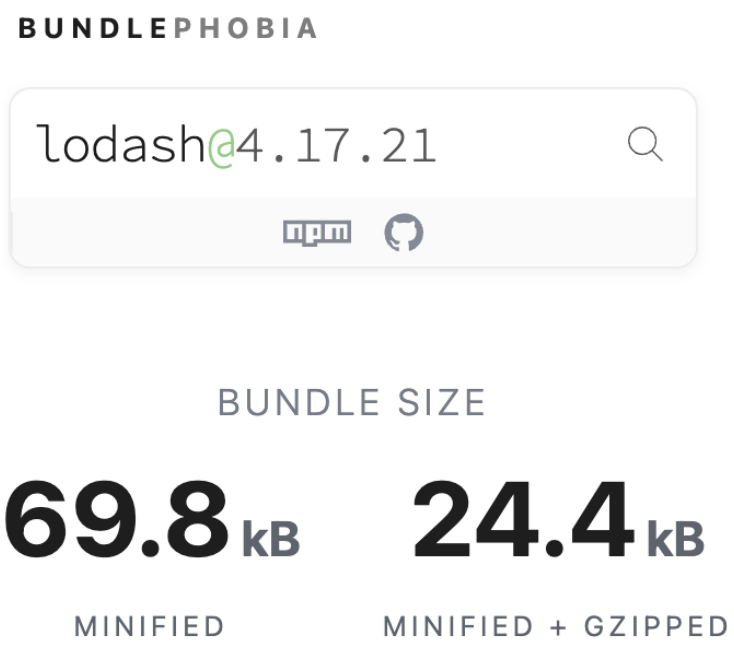


But there must be an easier way!

There is (at least kind of…)

Bundlephobia will tell you which packages are tree-shakeable:



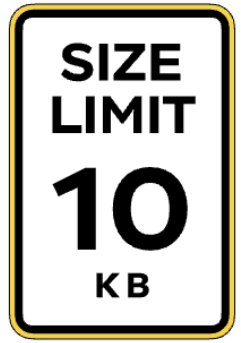


But there must be an easier way!

There is (at least kind of…)

Use size-limit (CLI tool) on CI to prevent unexpected increases:

Size Limit is a performance budget tool for JavaScript. It checks every commit on CI, calculates the real cost of your JS for end-users and throws an error if the cost exceeds the limit.



- **ES modules** and **tree-shaking** support.
- Add Size Limit to **Travis CI**, **Circle CI**, **GitHub Actions** or another CI system to know if a pull request adds a massive dependency.
- **Modular** to fit different use cases: big JS applications that use their own bundler or small npm libraries with many files.
- Can calculate **the time** it would take a browser to download and **execute** your JS. Time is a much more accurate and understandable metric compared to the size in bytes.
- Calculations include **all dependencies and polyfills** used in your JS.

But there must be an easier way!

There is (at least kind of…)

Use size-limit (CLI tool) on CI to prevent unexpected increases:

github-actions bot left a comment

size-limit report

Path	Size	Loading time (3g)	Running time (snapdragon)	Total time
dist/index.js	202.09 KB (+46.43% 🔺)	4.1 s (+46.43% 🔺)	397 ms (+21.74% 🔺)	4.5 s

😕 1

Pull Request Time!

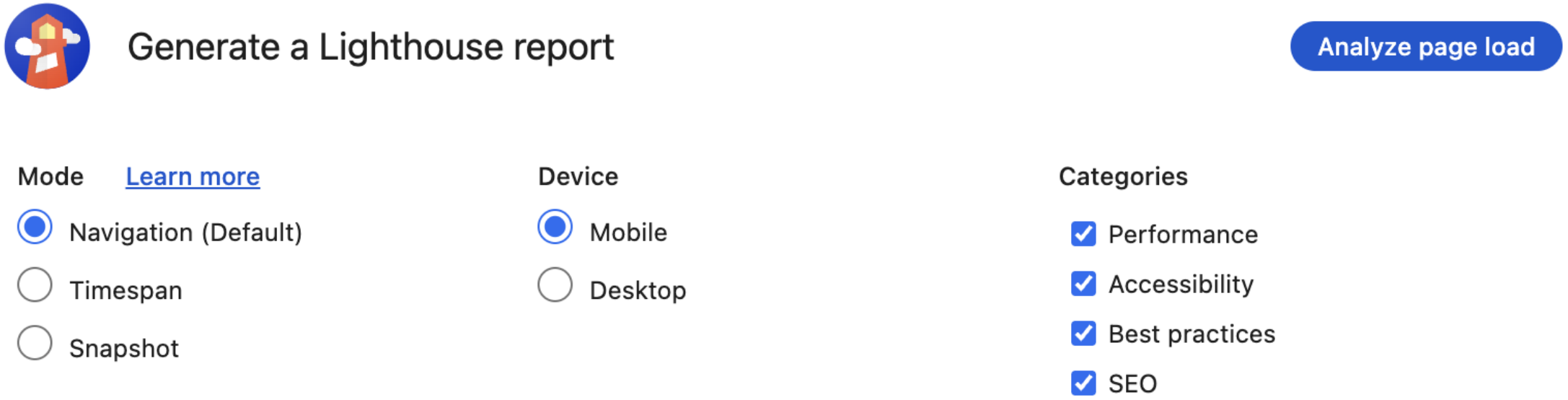
- „sure, you want to introduce lodash just because of isString? Thats a big fish!“

- **Difficult to predict by eye how (and if) bundlers will tree-shake**
- Using Import cost plugin and Bundlephobia can help make decisions quicker
- As with performance optimization in general:
  - **The only way to know for sure is by measuring!**

- Don‘t be afraid to use dependencies
  - But make sure they are tree-shaked!
  - Consider submitting a PR to the dependency if open source

How to measure speed of website?

1. In Chrome, open new window in incognito mode, turn all plugins off
2. Open Chrome Developer Tools
3. Switch to tab “Lighthouse”



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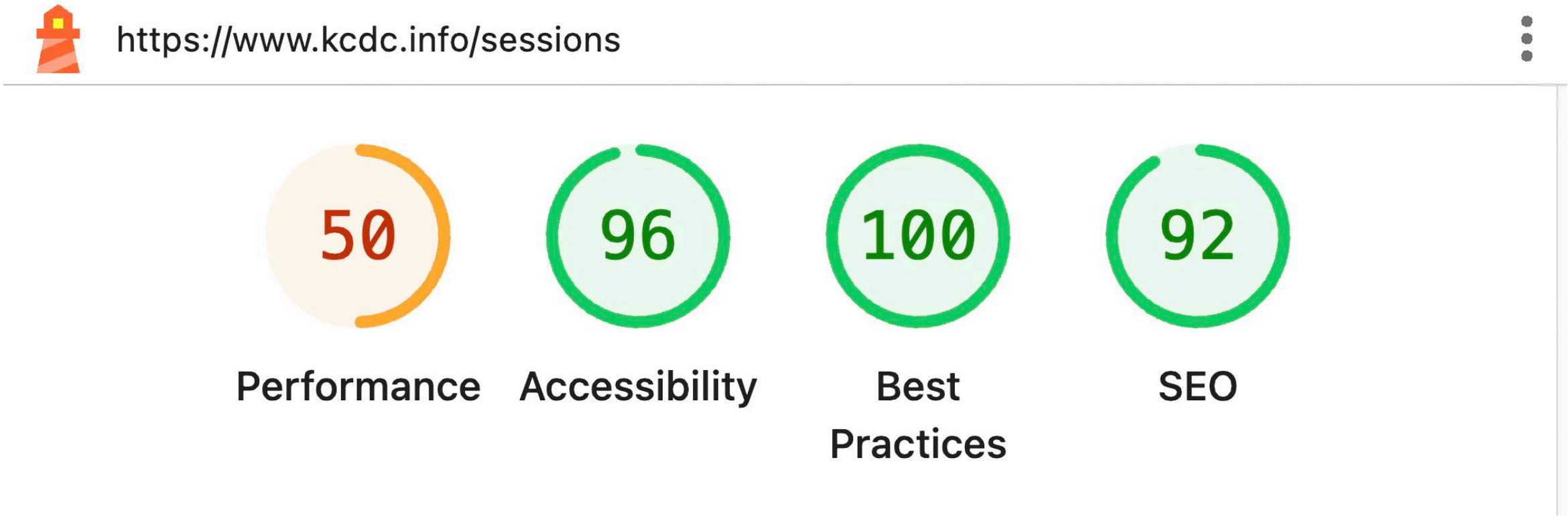

How to measure speed of website?

Add check on CI, for example GitHub Actions:

```
- name: Lighthouse
  shell: bash
  env:
    LHCI_GITHUB_TOKEN: ${{ secrets.GITHUB_TOKEN }}
  run: |
    npm install -g @lhci/cli@0.15.x && lhci autorun \
      --config=./lighthouserc.cjs
```

Tree Shaking!

Materials & eBook:

Feedback & Win!

https://fm.ht/kc25tree

https://fm.ht/kc25fb