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2017

# Tree Shaking 性能优化实践

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林溪



# 林溪

9年web 开发者，2013年加入百度

百度资深前端工程师

百度外卖前端架构师





# 目录

- 什么是tree shaking
- Tree shaking原理
- Tree shaking实践
- 总结





# 什么是tree shaking





去掉用不到的多余代码





# 支持tree shaking的构建工具



Rollup

Webpack2

Closure compiler





# Tree Shaking 原理



# Dead Code Elimination

## Dead Code

- 代码不会被执行，不可到达
- 代码执行的结果不会被用到
- 代码只会影响死变量（只写不读）

# 无用的模块消除

ES6 module 特点：

- 只能作为模块顶层的语句出现
- import 的模块名只能是字符串常量
- import binding 是 immutable 的

依赖关系是确定的，和运行时的状态无关  
可以进行可靠的静态分析，然后进行消除

1

# DCE试验

.babelrc

```
.babelrc x
1 {
2   "presets": [
3     ["es2015", { "modules": false }]
4   ]
5 }
```

```
1  let foo = () => {
2    let x = 1
3    if (false) {
4      console.log('never reached')
5    }
6    let a = 3
7    return a
8  }
9
10 let baz = () => {
11   var x = 1
12   console.log(x)
13   function unused () {
14     return 5
15   }
16   return x
17   let c = x + 3
18   return c
19 }
20
21 baz()
```

```
1 let foo = () => {
2   let x = 1
3   if (false) {
4     console.log('never reached')
5   }
6   let a = 3
7   return a
8 }
9
10 let baz = () => {
11   var x = 1
12   console.log(x)
13   function unused () {
14     return 5
15   }
16   return x
17   let c = x + 3
18   return c
19 }
20
21 baz()
```

rollup.bundle.js x

```
1 'use strict';
2
3 var baz = function baz() {
4   var x = 1;
5   console.log(x);
6   return x;
7   var c = x + 3;
8   return c;
9 };
10
11 baz();
```

webpack.bundle.js x

```
63 /******/ return __webpack_require
64 /******/ })
65 /******/ (
66 /******/ ([
67 /* 0 */
68 /******/ (function(module, exports)
69
70 var foo = function foo() {
71   var x = 1;
72   if (false) {
73     console.log('never reached');
74   }
75   var a = 3;
76   return a;
77 };
78
79 var baz = function baz() {
80   var x = 1;
81   console.log(x);
82   function unused() {
83     return 5;
84   }
85   return x;
86   var c = x + 3;
87   return c;
88 };
89
90 baz();
```

125B

3KB

Rollup自帶部分DCE  
Webpack 不做DCE

# Rollup/Webpack + Uglify

The image displays three code editors side-by-side, illustrating the process of bundling and minifying JavaScript code using Rollup and Webpack.

**main.js (Source Code):**

```
1 let foo = () => {
2   let x = 1
3   if (false) {
4     console.log('never reached')
5   }
6   let a = 3
7   return a
8 }
9
10 let baz = () => {
11   var x = 1
12   console.log(x)
13   function unused () {
14     return 5
15   }
16   return x
17   let c = x + 3
18   return c
19 }
20
21 baz()
```

**rollup.config.js (Rollup Configuration):**

```
1 import babel from 'rollup-plugin-babel'
2 import uglify from 'rollup-plugin-uglify'
3
4 export default {
5   entry: 'src/main.js',
6   dest: 'rollup.bundle.js',
7   format: 'cjs',
8   treeshake: true,
9   plugins: [
10    babel(),
11    uglify()
12  ]
13 }
14
15 plugins: [
16   new webpack.DefinePlugin({
17     'process.env': {
18       NODE_ENV: 'production'
19     }
20   }),
21 ],
22 new webpack.optimize.UglifyJsPlugin({
23   beautify: false,
24   comments: false,
25   compress: {
26     warnings: false,
27     collapse_vars: true,
28     reduce_vars: true
29   }
30 }),
31 new webpack.optimize.ModuleConcatenationPlugin()
32 ]
```

**rollup.bundle.js (Rollup Output):**

```
1 "use strict";var baz=function()
2 {return console.log(1),1};baz();
```

**webpack.bundle.js (Webpack Output):**

```
1 !function(n){function t(r){if(e
2 [r])return e[r].exports;var o=e
3 [r]={i:r,l:!1,exports:{}};
4 return n[r].call(o.exports,o,
5 o.exports,t),o.l=!0,o.exports}
6 var e={};t.m=n,t.c=e,
7 t.d=function(n,e,r){t.o(n,e)||
8 Object.defineProperty(n,e,
9 {configurable:!1,enumerable:!0,
10 get:r})},t.n=function(n){var
11 e=n&&n.__esModule?function()
12 {return n.default}:function()
13 {return n};return t.d(e,"a",e),
14 e},t.o=function(n,t){return
15 Object.prototype.hasOwnProperty.
16 call(n,t)},t.p="",t(t.s=0)}(
17 [function(n,t){!function()
18 {console.log(1)}()}]);
```

Annotations in the image:

- A blue box labeled "rollup" and a white box labeled "64B" are positioned above the Rollup output.
- A blue box labeled "rollup" and a white box labeled "517B" are positioned below the Webpack output.
- A green box highlights the minified code in the Webpack output.

Uglify实现DCE 

2

## 无用代码消除

- 函数消除试验
- 类消除试验

```
webpack.bundle.js x
post
[0])return t[o].exports,var l=0;
[o]={i:o,l:!1,exports:{}};
return e[o].call(r.exports,r,
r.exports,n),r.l=!0,r.exports}
var t={};n.m=e,n.c=t,
n.d=function(e,t,o){n.o(e,t)||
Object.defineProperty(e,t,
{configurable:!1,enumerable:!0,
get:o}}),n.n=function(e){var
t=e&&e.__esModule?function()
{return e.default}:function()
{return e};return n.d(t,"a",t),
t},n.o=function(e,n){return
Object.prototype.hasOwnProperty.
call(e,n)},n.p="",n(n.s=0)}(
[function(e,n,t){"use strict";
function o(){console.log("do
post")}Object.defineProperty(n,
"__esModule",{value:!0});
!function(){o();console.log(1)}
()]);
```

无用函数消除成功 

```
1 !function(n){function e(o){if(t[o])return t[o]
  .exports;var r=t[o]={i:o,l:!1,exports:{}};return n[o]
  .call(r.exports,r,r.exports,e),r.l=!0,r.exports}var
  t={};e.m=n,e.c=t,e.d=function(n,t,o){e.o(n,t)||
  Object.defineProperty(n,t,{configurable:!1,
  enumerable:!0,get:o})},e.n=function(n){var t=n&&
  n.__esModule?function(){return n.default}:function()
  {return n};return e.d(t,"a",t),t},e.o=function(n,e)
  {return Object.prototype.hasOwnProperty.call(n,e)},
  e.p="",e(e.s=0)}([function(n,e,t){"use strict";
  function o(){console.log("do post")}function r(n,e)
  {if(!(n instanceof e))throw new TypeError("Cannot
  call a class as a function")}Object.defineProperty(e,
  "__esModule",{value:!0});var i=function(){function n
  (n,e){for(var t=0;t<e.length;t++){var o=e[t];
  o.enumerable=o.enumerable||!1,o.configurable=!0,
  "value" in o&&(o.writable=!0),Object.defineProperty(n,
  o.key,o)}}return function(e,t,o){return t&&n
  (e.prototype,t),o&&n(e,o),e}}();!function(){function
  n(){r(this,n),this.display="none"}i(n, [{key:"show",
  value:function(){this.display="block"}}, {key:"hide",
  value:function(){this.display="none"}}, {key:"isShow",
  value:function(){return"block"===this.display}}])}();
  !function(){o();console.log(1)}()]);
```

消除失败



# D3

Rollup {treeshaking: false}

230KB

**Rollup {treeshaking: true}**

**96KB**

Webpack3

220KB



```
1
2 import { select } from 'd3'
3
4 var svg = select('svg')
5 svg.style('background', 'black')
6 svg.append('circle')
7   .attr('id', 'circle01')
8   .attr('cx', 200)
9   .attr('cy', 200)
10  .attr('r', 100)
11  .style('fill', 'lightgreen')
12
```

# Three.js

Rollup {treeshaking: false}

512KB

Rollup {treeshaking: true}

492KB

Webpack3

474KB

```
7 import {  
8   Vector3,  
9   Scene,  
10  Clock,  
11  PerspectiveCamera,  
12  WebGLRenderer,  
13  PointLight,  
14  MeshBasicMaterial,  
15  MeshFaceMaterial,  
16  DoubleSide,  
17  PlaneGeometry,  
18  Mesh,  
19  CubeGeometry,  
20  FogExp2  
21 } from 'three'
```

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# What Happened?



Victorystick commented on 11 May 2016

Owner



Indeed. Rollup only does tree-shaking for functions and variables that use `import / export` syntax. You're correct in assuming that classes can't have their methods tree-shaken; see [#349](#).



kzc commented on 2 Dec 2016

Contributor



Although the simple program above can be statically analyzed, in a more complex program any object property can be accessed in a dynamic fashion that cannot always be statically deduced:

```
var Person = (function(){
  var Person = function(){};
  Person.prototype.run = function run() { console.log("run"); }
  Person.prototype.jump = function jump() { console.log("jump"); }
  return Person;
})();
var p = new Person();
p.jump();

p[ Math.random() > 0.5 ? "run" : "jump" ]();
```

which is why rollup errs on the side of caution and retains all methods.



- Rollup只处理函数和import / export变量
- Javascript动态语言特性使得分析比较困难
- Side Effect广泛存在



Tree Shaking效果不佳

Tree Shaking对顶层纯函数效果更好



<https://github.com/rollup/d3-jsnext>



# Closure Compiler

## 编译命令

```
java -jar ./libs/closure-compiler-v20170626.jar --  
compilation_level ADVANCED_OPTIMIZATIONS --  
process_common_js_modules --transform_amd_modules --  
-language_in ECMASCRIPT6 --js src/main.js --js  
src/util.js --js src/menu.js --js_output_file  
cc.bundle.js --process_common_js_modules
```

## 输出结果

JS cc.bundle.js ✕

```
1 console.log("do post");console.log(1);|  
2
```

```
js menu.js  js util.js  x
1 goog.provide('util')
2
3 export function post () {
4   console.log('do post')
5 }
6
7 post.prototype.before = () => {
8   console.log('before')
9 }
10
11 export function get () {
12   console.log('do get')
13 }
14
```

侵入式

Annotating JavaScript for  
the Closure Compiler

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Tree Shaking对web意义重大  
但目前还处在发展阶段

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Webpack 2升级



Webpack 3升级



## 问题

- 效果不明显
- 无用的代码并没有完全消除
- rollup也不能根本解决问题
- Closure compiler有侵入，需要改代码

# babel-plugin-import-fix

<https://github.com/lin-xi/babel-plugin-import-fix>

## 减小import范围

```
import ReactDOM from 'react-dom'

import { Button } from 'antd';

ReactDOM.render(
  <div>
    <Button onClick={onClick} />
  </div>,
  document.body);

function onClick() {
  console.log('click');
}
```

1.5MB

```
import ReactDOM from 'react-dom'

import {Button} from 'antd/lib/button';
import 'antd/lib/style';

ReactDOM.render(
  <div>
    <Button onClick={onClick} />
  </div>,
  document.body);

function onClick() {
  console.log('click');
}
```

310KB



```
{
  visitor: {
    Program(path, { opts = {} }) {}, //根结点
    ImportDeclaration() {}, //import语句
    CallExpression() {}, //函数调用表达式
    MemberExpression() {}, //对象属性表达式
    VariableDeclarator() {}, //变量定义语句
    LogicalExpression() {}, //逻辑表达式
    ConditionalExpression() {}, //三目运算表达式
    IfStatement() {}, //if语句
    ExpressionStatement() {}, //表达式语句
    ReturnStatement() {}, //return语句
    ExportDefaultDeclaration() {}, //export default 语句
    BinaryExpression() {}, //算术表达式
  }
}
```





# 支持库



XCUI





Three.js

pixi.js

echarts.js



为了能被shake：

- 使用ES6模块规范 [静态分析]
- 构建模块化的输出 [package.json module字段]
- 组件模块独立输出 [import-fix]

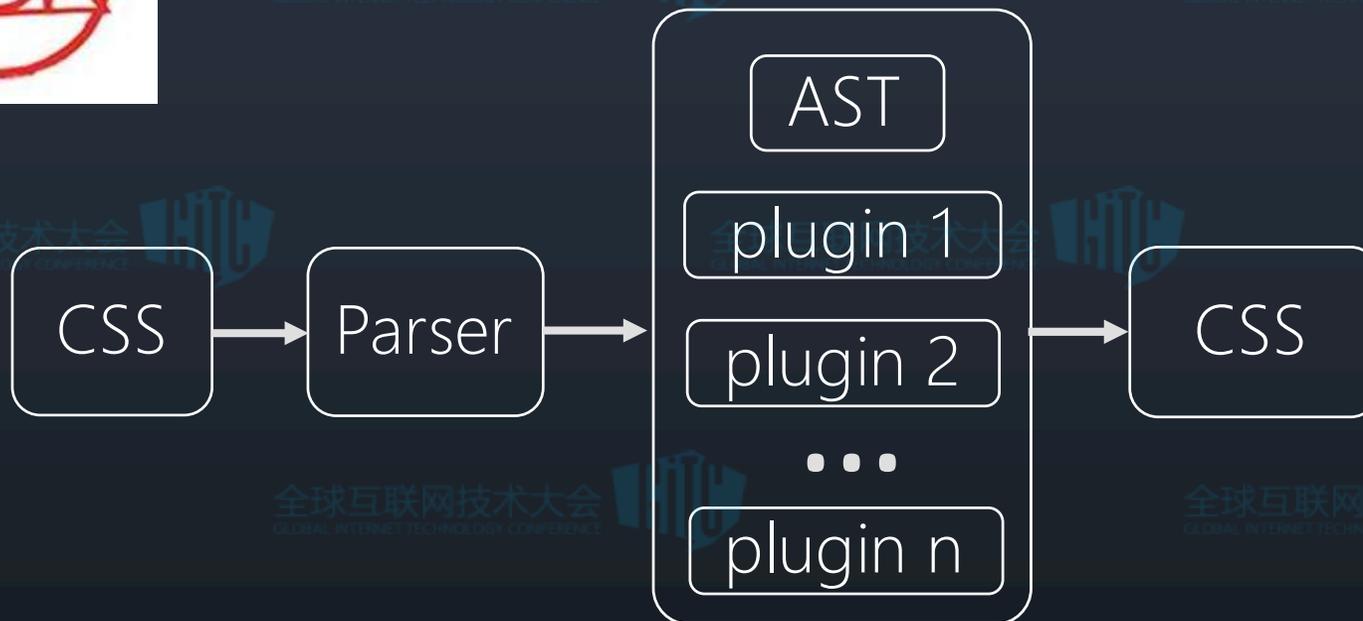


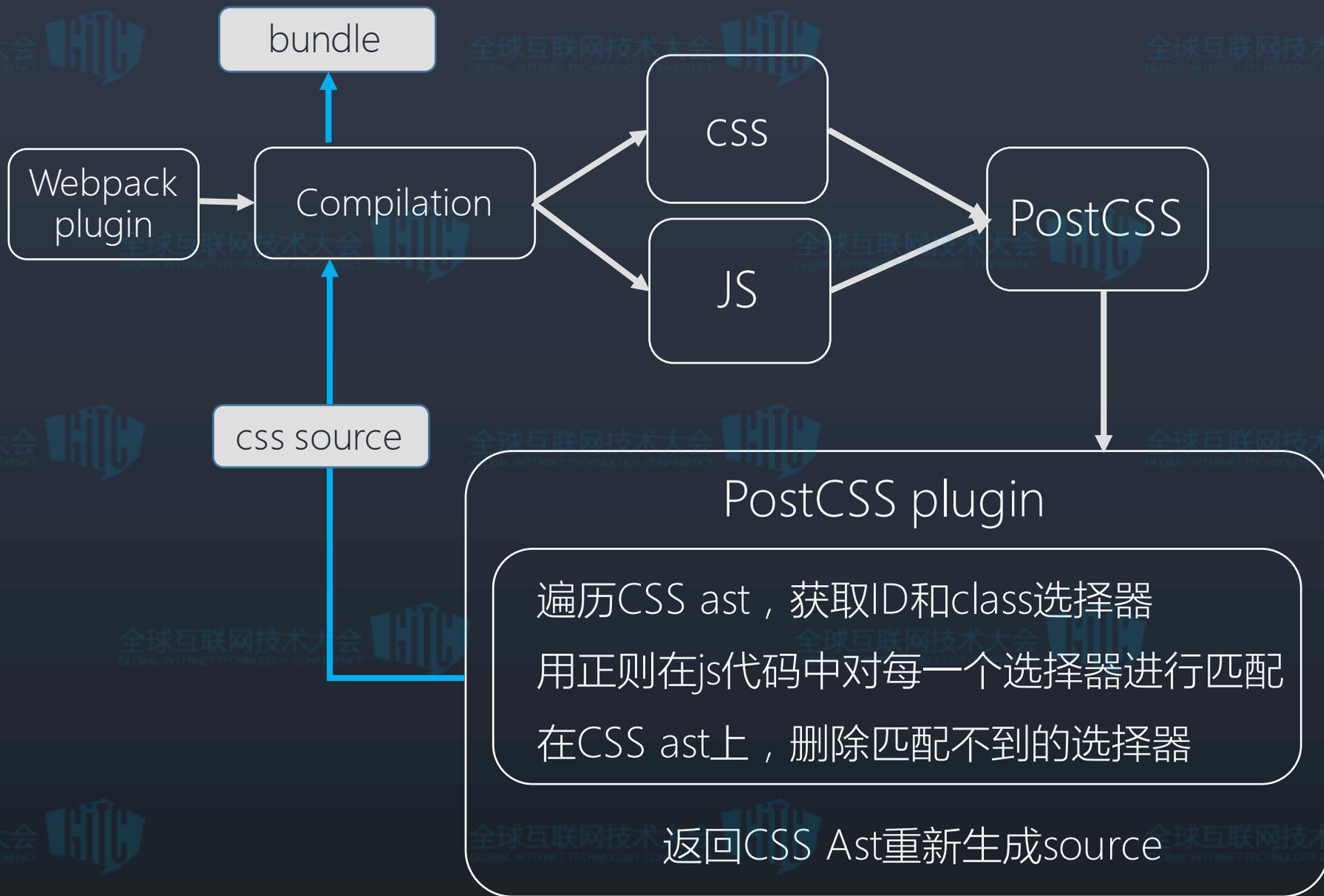
# webpack-css-treeshaking-plugin

<https://github.com/lin-xi/webpack-css-treeshaking-plugin>



PostCSS







- Side Effect 也存在

```
1 <template>
2   <div class="compo-paper">
3     <div class="{ 'page-header': showHeader }">
4       <div class="user-name">
5         </div>
6     </div>
7   </div>
8 </template>
```

Vue

```
2 render(){
3   let headerClass = showHeader ? 'headerClass' : '';
4   return (
5     <div class="compo-paper">
6       <div class="{headerClass}">
7         <div class="user-name">
8           </div>
9       </div>
10    </div>
11  )
}
```

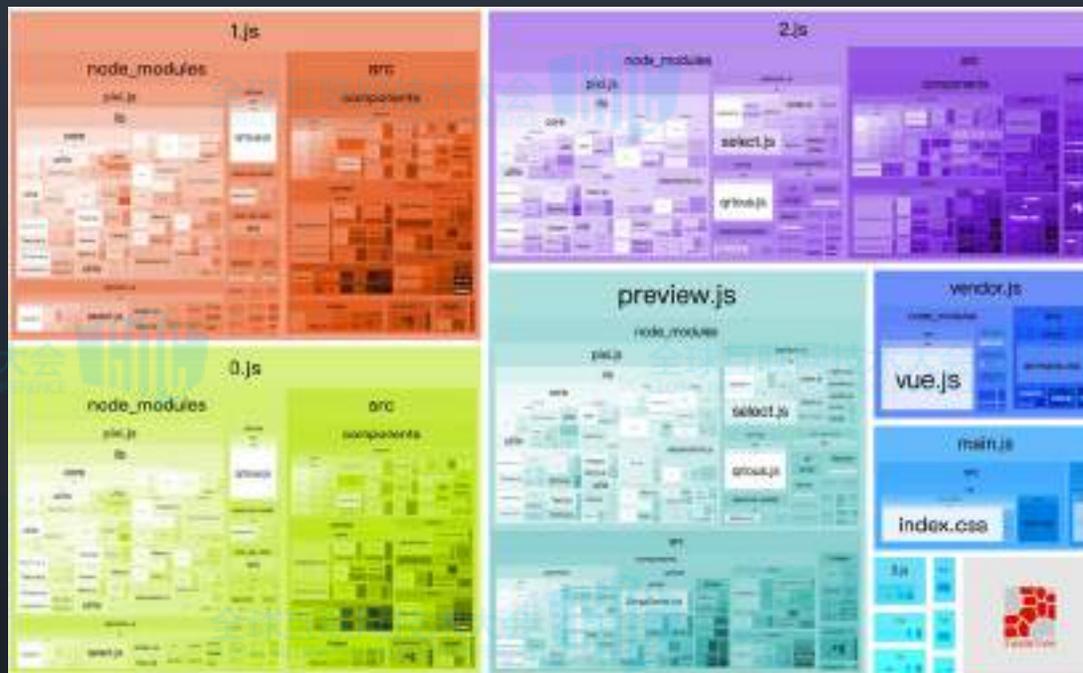
React



# 广义Tree Shaking, bundle去重

1

webpack-bundle-analyzer



2

## CommonsChunkPlugin

```
entry: {  
  main: [path.join(__dirname, './src/main.js')],  
  preview: [path.join(__dirname, './src/preview.js')],  
  vendor: ['vue']  
},
```

```
new webpack.optimize.CommonsChunkPlugin({  
  name: 'vendor',  
}),
```

### 问题

- Vendor需要不停的手动维护
- 不能使用babel-plugin-import-fix插件

# 自动维护通用模块

```
new webpack.optimize.CommonsChunkPlugin({
  name: 'vendor',
  minChunks: (module, count) => [
    (module.context && module.context.indexOf('node_modules') !== -1)
    || count >= 2
  ]
}),
```

- 去除vendor entry
- 自动将所有的node\_module和出现两次及以上的文件打包
- babel-plugin-import-fix 生效

## 问题

- 异步模块没有得到优化

```
new webpack.optimize.CommonsChunkPlugin({
  name: 'vendor',
  minChunks: (module, count) => [(
    (module.context && module.context.indexOf('node_modules') !== -1)
    || count >= 2
  )]
}),
new webpack.optimize.CommonsChunkPlugin({
  names: ['main', 'preview', 'EditPage', 'MinePage', 'Mine
  async: 'async-common',
  minChunks: 2
}),
```

Perfect !  
彻底去重



### Show chunks:

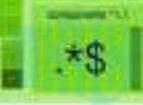
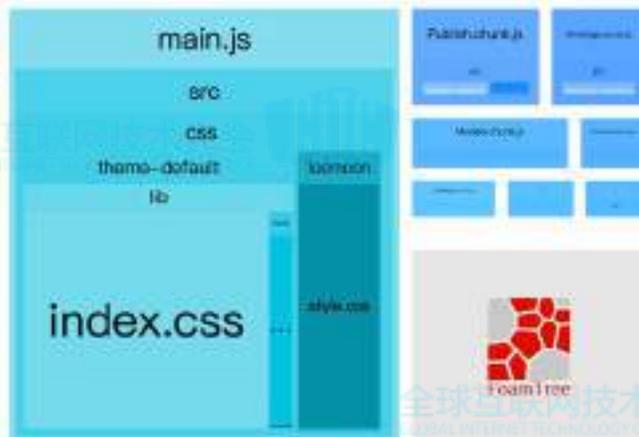
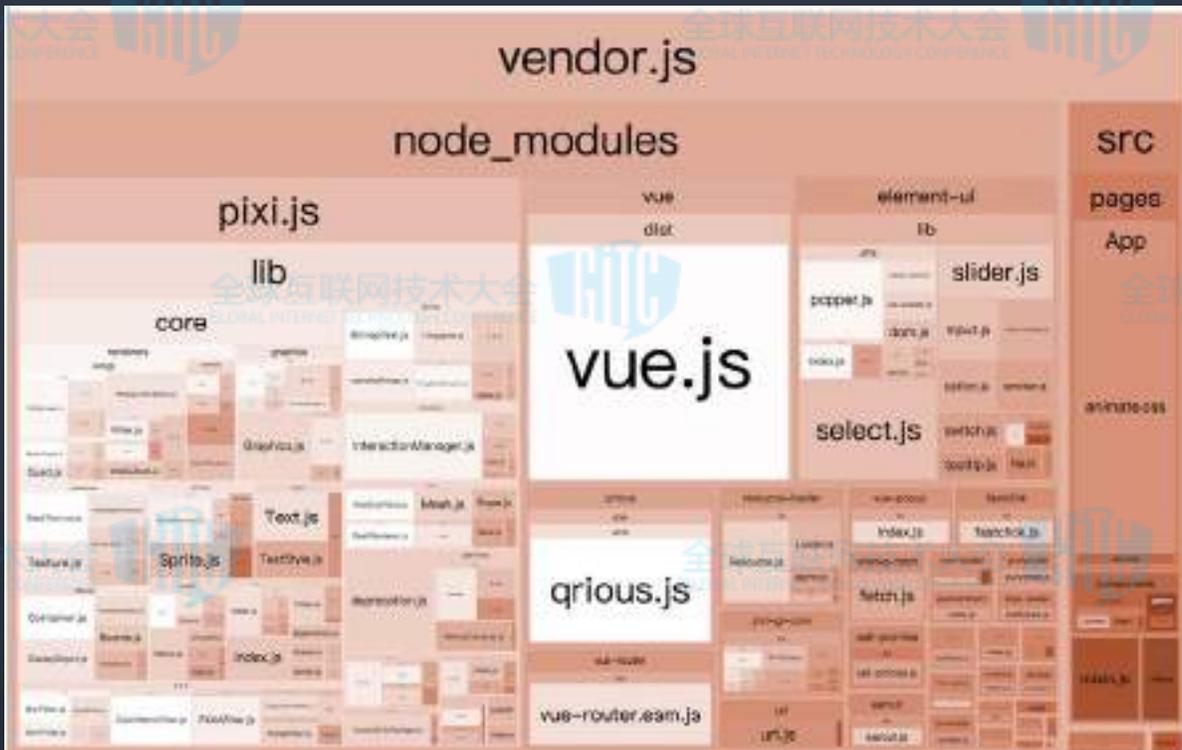
- All (**4.29 MB**)
- preview.js (**1.11 MB**)
- MinePage.chunk.js (**938.51 KB**)
- Models.chunk.js (**937.62 KB**)
- EditPage.chunk.js (**930.4 KB**)
- main.js (**386.77 KB**)
- Publish.chunk.js (**18.99 KB**)
- MinePublish.chunk.js (**12.74 KB**)
- MediaUpload.chunk.js (**11.8 KB**)
- MineWidget.chunk.js (**8.93 KB**)
- MineComponent.chunk.js (**8.2 KB**)
- RealTime.chunk.js (**4.51 KB**)

### Show chunks:

- All (**1.71 MB**)
- vendor.js (**779.8 KB**)
- async-common-main.chunk.js (**381.74 KB**)
- preview.js (**380.34 KB**)
- main.js (**154.72 KB**)
- Publish.chunk.js (**13.06 KB**)
- MinePage.chunk.js (**9.97 KB**)
- Models.chunk.js (**9.06 KB**)
- MinePublish.chunk.js (**4.17 KB**)
- EditPage.chunk.js (**3.98 KB**)
- MediaUpload.chunk.js (**3.24 KB**)
- MineWidget.chunk.js (**3 KB**)
- MineComponent.chunk.js (**2.27 KB**)
- RealTime.chunk.js (**2.08 KB**)









# 总结



Tree shaking 做了些什么

Tree shaking 适用场景

Babel插件减少import范围

Css tree shaking

Bundle去重



使用ES6模块

Tree Shaking不能解决所有问题，重视Eslint

减少side effect，无状态函数式编程



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# 谢谢

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