1. webpack介绍

- Webpack是一个前端资源加载/打包工具。它将根据模块的依赖关系进行静态分析，然后将这些模块按照指定的规则生成对应的静态资源。
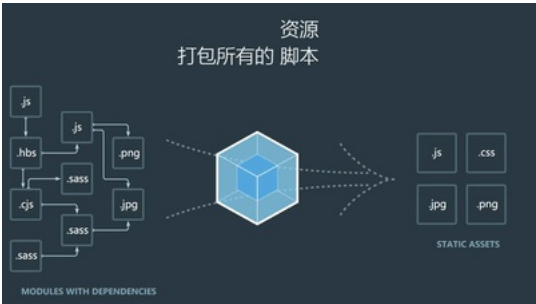
2. 预备知识

2.1 toStringTag

- Symbol.toStringTag 是一个内置 symbol，它通常作为对象的属性键使用，对应的属性值应该为字符串类型，这个字符串用来表示该对象的自定义类型标签，通常只有内置的 Object.prototype.toString() 方法会去读取这个标签并把它包含在自己的返回值里。

```
console.log(Object.prototype.toString.call('foo'));
console.log(Object.prototype.toString.call([1, 2]));
console.log(Object.prototype.toString.call(3));
console.log(Object.prototype.toString.call(true));
console.log(Object.prototype.toString.call(undefined));
console.log(Object.prototype.toString.call(null));
let myExports={};
Object.defineProperty(myExports, Symbol.toStringTag, { value: 'Module' });
console.log(Object.prototype.toString.call(myExports));
```

2.2 Object.create(null)

- 使用 create 创建的对象，没有任何属性，把它当作一个非常纯净的map来使用，我们可以自己定义 hasOwnProperty、toString方法,完全不必担心会将原型链上的同名方法覆盖掉
- 在我们使用 for..in 循环的时候会遍历对象原型链上的属性，使用 create(null) 就不必再对属性进行检查了

```
var ns = Object.create(null);
if (typeof Object.create !== "function") {
    Object.create = function (proto) {
        function F() {}
        F.prototype = proto;
        return new F();
    };
}
console.log(ns)
console.log(Object.getPrototypeOf(ns));
```

2.3 getter

- defineProperty (https://developer.mozilla.org/zh-CN/docs/Web/JavaScript/Reference/Global_Objects/Object/defineProperty) 方法会直接在一个对象上定义一个新属性，或者修改一个对象的现有属性，并返回这个对象。
    - obj 要在其上定义属性的对象。
    - prop 要定义或修改的属性的名称。
    - descriptor 将被定义或修改的属性描述符。

2.3.1 描述符可同时具有的键值

configurable enumerable value writable get set 数据描述符 Yes Yes Yes Yes No No 存取描述符 Yes Yes No No Yes Yes

2.3.2 示例

```
var ageValue = 10;
let obj = {};
Object.defineProperty(obj, "age", {

    get() {
        return ageValue;
    },
    set(newValue) {
        ageValue = newValue;
    },

    enumerable: true,
    configurable: true
});
Object.defineProperty(obj, "name", {
    value: 'zhufeng',
    writable: true,
    enumerable: true,
    configurable: true
});
console.log(obj.age, obj.name);
obj.age = 100;
obj.name = 'jiagou';
console.log(obj.age, obj.name);
```

2. 同步加载

2.1 webpack.config.js

```js
const path = require('path');
const HtmlWebpackPlugin=require('html-webpack-plugin');
module.exports = {
  mode:'development',
  devtool:"none",
  context: process.cwd(),
  entry: './src/index.js',
  output: {
    filename: 'bundle.js'
  },
  devServer:{
    contentBase:path.resolve(__dirname,'./dist')
  },
  module: {
    rules: [
      {
        test: /\.js$/,
        use: {
          loader: "babel-loader",
          options: {
            presets:["@babel/preset-env"]
          }
        },
        include: path.join(__dirname, "src"),
        exclude: /node_modules/
      }
    ]
  },
  plugins: []
};
```

2.2 index.js

src\index.js

```js
let title = require('./title.js');
console.log(title);
```

2.3 title.js

src\title.js

```js
module.exports = "title";
```

2.4 打包文件分析

```javascript
(function(modules) {

  var installedModules = {};

  function __webpack_require__(moduleId) {

    if (installedModules[moduleId]) {
      return installedModules[moduleId].exports;
    }

    var module = (installedModules[moduleId] = {
      i: moduleId,
      l: false,
      exports: {}
    });

    modules[moduleId].call(
      module.exports,
      module,
      module.exports,
      __webpack_require__
    );

    module.l = true;

    return module.exports;
  }

  __webpack_require__.m = modules;

  __webpack_require__.c = installedModules;

  __webpack_require__.d = function(exports, name, getter) {
    if (!__webpack_require__.o(exports, name)) {
      Object.defineProperty(exports, name, { enumerable: true, get: getter });
    }
  };

  __webpack_require__.r = function(exports) {
    if (typeof Symbol !== "undefined" && Symbol.toStringTag) {
      Object.defineProperty(exports, Symbol.toStringTag, { value: "Module" });
    }
    Object.defineProperty(exports, "__esModule", { value: true });
  };

  __webpack_require__.t = function(value, mode) {
    if (mode & 1) value = __webpack_require__(value);
    if (mode & 8) return value;
    if (mode & 4 && typeof value === "object" && value && value.__esModule)
      return value;
    var ns = Object.create(null);
    __webpack_require__.r(ns);
    Object.defineProperty(ns, "default", { enumerable: true, value: value });
    if (mode & 2 && typeof value != "string")
      for (var key in value)
        __webpack_require__.d(
          ns,
          key,
          function(key) {
            return value[key];
          }.bind(null, key)
        );
    return ns;
  };

  __webpack_require__.n = function(module) {
    var getter =
      module && module.__esModule
        ? function getDefault() {
            return module["default"];
          }
        : function getModuleExports() {
            return module;
          };
    __webpack_require__.d(getter, "a", getter);
    return getter;
  };

  __webpack_require__.o = function(object, property) {
    return Object.prototype.hasOwnProperty.call(object, property);
  };

  __webpack_require__.p = "";

  return __webpack_require__((__webpack_require__.s = "./src/index.js"));
})({
  "./src/index.js": function(module, exports, __webpack_require__) {
    var title = __webpack_require__("./src/title.js");
    console.log(title);
  },
  "./src/title.js": function(module, exports) {
    module.exports = "title";
  }
});
```

2.5 实现

2.5.1 webpack_require

- 实现require方法

```javascript
(function(modules){
    var installedModules = {};
    function __webpack_require__(moduleId){
        if(installedModules[moduleId]){
            return installedModules[moduleId];
        }
        var module = installedModules[moduleId] = {
            i:moduleId,
            l:false,
            exports:{}
        }
        modules[moduleId].call(modules.exports,module,module.exports,__webpack_require__);
        module.l = true;
        return module.exports;
    }
    return __webpack_require__((__webpack_require__.s = "./src/index.js"));
})({
    "./src/index.js":function(module,exports,__webpack_require__){
        var title = __webpack_require__('./src/title.js');
        console.log(title);
    },
    "./src/title.js":function(module,exports){
      module.exports = "title";
    }
})
```

2.5.2 d(defineProperty) #

- 通过 getter的方式增加属性

```javascript
function d(exports, name, getter) {
    if (!exports.hasOwnProperty(name)) {
        Object.defineProperty(exports, name, { get: getter });
    }
}

let obj = {};
function ageGetter() {
    return 10;
}
d(obj, 'age', ageGetter);
console.log(obj.age);
```

2.5.3 r #

- 表示此对象是一个ES6模块对象

```javascript
function r(exports) {
  Object.defineProperty(exports, Symbol.toStringTag, { value: 'Module' });
  Object.defineProperty(exports, '__esModule', { enumerable: true, value: true });
};
let obj2 = {};
r(obj2);
console.log(obj2);
```

2.5.4 n #

- 获取此对象的默认导出

```javascript
function n(module) {
    var getter = module.__esModule ?
        function () { return module['default']; } :
        function () { return module; };
    d(getter, 'a', getter);
    return getter;
};
let m = { age: 10 };
let getter = n(m);
console.log(getter.a);
let m2 = { default: { age: 20 }, __esModule: true };
let getter2 = n(m2);
console.log(getter2.a);
```

2.5.5 t #

- 把任意模块包装成ES6模块
- mode & 1: value is a module id, require it 表示传的是模块ID
- mode & 2: merge all properties of value into the ns 需要合并属性
- mode & 4: return value when already ns object 如果是ES6模块直接返回
- mode & 8|1: behave like require 等同于require方法

```javascript
let modules = {

    'moduleA': function (module, exports) {
        module.exports = 'moduleA导出内容';
    },

    'moduleB': function (module, exports) {
        module.exports = { __esModule: true, default: 'moduleB导出内容' };
    },

    'moduleC': function (module, exports) {
        module.exports = { name: 'moduleC导出内容' };
    }
}
function __webpack_require__(moduleId) {
    var module = {
        i: moduleId,
        l: false,
        exports: {}
    }
    modules[moduleId].call(modules.exports, module, module.exports, __webpack_require__);
    module.l = true;
    return module.exports;
}
function t(value, mode) {
    if (mode & 1) value = __webpack_require__(value);
    if (mode & 8) return value;
    if ((mode & 4) && typeof value === 'object' && value && value.__esModule) return value;
    var ns = Object.create(null);
    Object.defineProperty(ns, Symbol.toStringTag, { value: 'Module' });
    Object.defineProperty(ns, '__esModule', { enumerable: true, value: true });
    Object.defineProperty(ns, 'default', { enumerable: true, value: value });
    if (mode & 2 && typeof value != 'string')
        for (var key in value)
            Object.defineProperty(ns, key, { enumerable: true, get: () => value[key] });
    return ns;
};
let result1 = t('moduleA', 0b1001);
console.log(result1);
let result2 = t('moduleB', 0b0101);
console.log(result2);
let result3 = t('moduleC', 0b0011);
console.log(result3, result3.name);
```

3. harmony

3.1 common.js加载 common.js

3.1.1 index.js

```javascript
let title = require('./title');
console.log(title.name);
console.log(title.age);
```

3.1.2 title.js

```javascript
exports.name = 'title_name';
exports.age = 'title_age';
```

3.1.3 bundle.js

```javascript
{
"./src/index.js":
  (function(module, exports, __webpack_require__) {
    var title = __webpack_require__("./src/title.js");
    console.log(title.name);
    console.log(title.age);
  }),
"./src/title.js":
  (function(module, exports) {
    exports.name = 'title_name';
    exports.age = 'title_age';
  })
}
```

3.2 common.js加载 ES6 modules


```
▼ Module {default: "title_name", __esModule: true, Symbol(Symbol.toStringTag): "Module"} ℹ
    age: (...)
    default: "title_name"
    Symbol(Symbol.toStringTag): "Module"
    __esModule: true
  ▶ get age: ƒ ()
  ▶ __proto__: Object
─────────────────────────────────────────
  title_name
─────────────────────────────────────────
  title_age
```

3.2.1 index.js

```javascript
let title = require('./title');
console.log(title);
console.log(title.default);
console.log(title.age);
```

3.2.2 title.js

```
export default name = 'title_name';
export const age = 'title_age';
```

3.2.3 bundle.js

```
{
    "./src/index.js":
        (function (module, exports, __webpack_require__) {
            var title = __webpack_require__( "./src/title.js");
            console.log(title.name);
            console.log(title.age);
        }),

    "./src/title.js":
        (function (module, __webpack_exports__, __webpack_require__) {
            __webpack_require__.r(__webpack_exports__);

            __webpack_require__.d(__webpack_exports__, "age", function () { return age; });

            __webpack_exports__["default"] = (name = 'title_name');
            var age = 'title_age';
        })
}
```

3.3 ES6 modules 加载 ES6 modules

3.3.1 index.js

```
import name,{age} from './title';
console.log(name);
console.log(age);
```

3.3.2 title.js

```
export default name  = 'title_name';
export const age = 'title_age';
```

3.3.3 bundle.js

```
{

    "./src/index.js":
        (function (module, __webpack_exports__, __webpack_require__) {
            "use strict";
            __webpack_require__.r(__webpack_exports__);
            var _title__WEBPACK_IMPORTED_MODULE_0__ = __webpack_require__( "./src/title.js");
            console.log(_title__WEBPACK_IMPORTED_MODULE_0__["default"]);
            console.log(_title__WEBPACK_IMPORTED_MODULE_0__["age"]);
        }),
    "./src/title.js":
        (function (module, __webpack_exports__, __webpack_require__) {
            __webpack_require__.r(__webpack_exports__);
            __webpack_require__.d(__webpack_exports__, "age", function () { return age; });
            __webpack_exports__["default"] = (name = 'title_name');
            var age = 'title_age';
        })
}
```

3.4 ES6 modules 加载 common.js

3.4.1 index.js

```
import home, { name, age } from './title';
console.log(name);
console.log(age);
console.log(home);
```

3.4.2 title.js

```
module.exports = { home: 'beijing' };
module.exports.name = 'title_name';
module.exports.age = 'title_age';
```

3.4.3 bundle.js

```
  {
    "./src/index.js":
        (function (module, __webpack_exports__, __webpack_require__) {
            __webpack_require__.r(__webpack_exports__);
    var _title__WEBPACK_IMPORTED_MODULE_0__ = __webpack_require__( "./src/title.js");
    var _title__WEBPACK_IMPORTED_MODULE_0___default = __webpack_require__.n(_title__WEBPACK_IMPORTED_MODULE_0__);
            console.log(_title__WEBPACK_IMPORTED_MODULE_0__["name"]);
            console.log(_title__WEBPACK_IMPORTED_MODULE_0__["age"]);
            console.log(_title__WEBPACK_IMPORTED_MODULE_0___default.a);
        }),

    "./src/title.js":
        (function (module, exports) {
            module.exports = {
                home: 'beijing'
            };
            module.exports.name = 'title_name';
            module.exports.age = 'title_age';
        })
}
```

4. 异步加载

4.1 源文件

4.1.1 index.html

```
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>Documenttitle>
head>
<body>
body>
html>
```

4.1.2 src\index.js #

src\index.js

```
let button = document.createElement("button");
button.innerHTML = "点我";
button.onclick = function () {
    import('./title.js').then(function (result) {
        console.log(result, result.default);
    });
};
document.body.appendChild(button);
```

4.1.3 src\title.js #

src\title.js

```
module.exports = {
    name: 'title'
}
module.exports.age = 10;
```

4.2 打包后的文件 #

4.2.1 #

```
(function (modules) {

  function webpackJsonpCallback(data) {
    var chunkIds = data[0];
    var moreModules = data[1];

    var moduleId, chunkId, i = 0, resolves = [];
    for (; i < chunkIds.length; i++) {
      chunkId = chunkIds[i];
      if (installedChunks[chunkId]) {
        resolves.push(installedChunks[chunkId][0]);
      }
      installedChunks[chunkId] = 0;
    }
    for (moduleId in moreModules) {
      if (Object.prototype.hasOwnProperty.call(moreModules, moduleId)) {
        modules[moduleId] = moreModules[moduleId];
      }
    }
    if (parentJsonpFunction) parentJsonpFunction(data);

    while (resolves.length) {
      resolves.shift()();
    }
  };

  var installedModules = {};

  var installedChunks = {
    "main": 0
  };

  function jsonpScriptSrc(chunkId) {
    return __webpack_require__.p + "" + chunkId + ".bundle.js"
  }

  function __webpack_require__(moduleId) {
    if (installedModules[moduleId]) {
      return installedModules[moduleId].exports;
    }
    var module = installedModules[moduleId] = {
      i: moduleId,
      l: false,
      exports: {}
    };
    modules[moduleId].call(module.exports, module, module.exports, __webpack_require__);
    module.l = true;
    return module.exports;
  }

  __webpack_require__.e = function requireEnsure(chunkId) {
    var promises = [];

    var installedChunkData = installedChunks[chunkId];
    if (installedChunkData !== 0) {

      if (installedChunkData) {
        promises.push(installedChunkData[2]);
      } else {

        var promise = new Promise(function (resolve, reject) {
          installedChunkData = installedChunks[chunkId] = [resolve, reject];
        });
        promises.push(installedChunkData[2] = promise);

        var script = document.createElement('script');
```

```javascript
        var onScriptComplete;

        script.charset = 'utf-8';
        script.timeout = 120;

        if (__webpack_require__.nc) {
          script.setAttribute("nonce", __webpack_require__.nc);
        }

        script.src = jsonpScriptSrc(chunkId);

        var error = new Error();
        onScriptComplete = function (event) {
          script.onerror = script.onload = null;
          clearTimeout(timeout);
          var chunk = installedChunks[chunkId];
          if (chunk !== 0) {
            if (chunk) {
              var errorType = event && (event.type === 'load' ? 'missing' : event.type);
              var realSrc = event && event.target && event.target.src;
              error.message = 'Loading chunk ' + chunkId + ' failed.\n(' + errorType + ': ' + realSrc + ')';
              error.name = 'ChunkLoadError';
              error.type = errorType;
              error.request = realSrc;
              chunk[1](error);
            }
            installedChunks[chunkId] = undefined;
          }
        };
        var timeout = setTimeout(function () {
          onScriptComplete({ type: 'timeout', target: script });
        }, 120000);
        script.onerror = script.onload = onScriptComplete;
        document.head.appendChild(script);
      }
    }
    return Promise.all(promises);
  };

  __webpack_require__.m = modules;

  __webpack_require__.c = installedModules;

  __webpack_require__.d = function (exports, name, getter) {
    if (!__webpack_require__.o(exports, name)) {
      Object.defineProperty(exports, name, { enumerable: true, get: getter });
    }
  };

  __webpack_require__.r = function (exports) {
    if (typeof Symbol !== 'undefined' && Symbol.toStringTag) {
      Object.defineProperty(exports, Symbol.toStringTag, { value: 'Module' });
    }
    Object.defineProperty(exports, '__esModule', { value: true });
  };

  __webpack_require__.t = function (value, mode) {
    if (mode & 1) value = __webpack_require__(value);
    if (mode & 8) return value;
    if ((mode & 4) && typeof value === 'object' && value && value.__esModule) return value;
    var ns = Object.create(null);
    __webpack_require__.r(ns);
    Object.defineProperty(ns, 'default', { enumerable: true, value: value });
    if (mode & 2 && typeof value != 'string') for (var key in value) __webpack_require__.d(ns, key, function (key) { return value[key]; }.bind(null, key));
    return ns;
  };

  __webpack_require__.n = function (module) {
    var getter = module && module.__esModule ?
      function getDefault() { return module['default']; } :
      function getModuleExports() { return module; };
    __webpack_require__.d(getter, 'a', getter);
    return getter;
  };

  __webpack_require__.o = function (object, property) { return Object.prototype.hasOwnProperty.call(object, property); };

  __webpack_require__.p = "";

  __webpack_require__.oe = function (err) { console.error(err); throw err; };

  var jsonpArray = window["webpackJsonp"] = window["webpackJsonp"] || [];

  var oldJsonpFunction = jsonpArray.push.bind(jsonpArray);

  jsonpArray.push = webpackJsonpCallback;

  jsonpArray = jsonpArray.slice();

  for (var i = 0; i < jsonpArray.length; i++) webpackJsonpCallback(jsonpArray[i]);

  var parentJsonpFunction = oldJsonpFunction;

  return __webpack_require__(__webpack_require__.s = "./src/index.js");
})
({

  "./src/index.js":
    (function (module, exports, __webpack_require__) {
      var button = document.createElement("button");
      button.innerHTML = "点我";
      button.onclick = function () {
        __webpack_require__.e("title").then(__webpack_require__.t.bind(null, "./src/title.js", 7)).then(function (result) {
          console.log(result["default"]);
```

```
        });
    };
    document.body.appendChild(button);
  })
});
```

4.2.2 title.bundle.js #

dist\title.bundle.js

```
(window["webpackJsonp"] = window["webpackJsonp"] || []).push([["title"], {
 "./src/title.js":
   (function (module, exports) {
     module.exports = {
       name: 'title'
     };
     module.exports.age = 10;
   })
}]);
```

4.3 实现 bundle.js #

```
(function (modules) {
    var installedModules = {};
    function __webpack_require__(moduleId) {
        if (installedModules[moduleId]) {
            return installedModules[moduleId].exports;
        }
        var module = installedModules[moduleId] = {
            i: moduleId,
            l: false,
            exports: {}
        }
        modules[moduleId].call(modules.exports, module, module.exports, __webpack_require__);
        module.l = true;
        return module.exports;
    }
    var installedChunks = {
        "main": 0
    };

    function webpackJsonpCallback(data) {
        var chunkIds = data[0];
        var moreModules = data[1];
        var moduleId, chunkId, resolves = [];
        for (let i = 0; i < chunkIds.length; i++) {
            chunkId = chunkIds[i];
            resolves.push(installedChunks[chunkId][0]);
            installedChunks[chunkId] = 0;
        }
        for (moduleId in moreModules) {
            modules[moduleId] = moreModules[moduleId];
        }
        while (resolves.length) {
            resolves.shift()();
        }
    }
    __webpack_require__.t = function (value) {
        value = __webpack_require__(value);
        var ns = Object.create(null);
        ns.default = value;
        return ns;
    };
    __webpack_require__.e = function (chunkId) {
        var promises = [];
        var installedChunkData = installedChunks[chunkId];
        if (installedChunkData !== 0) {
            var promise = new Promise(function (resolve, reject) {
                installedChunkData = installedChunks[chunkId] = [resolve, reject];
            });
            installedChunkData[2] = promise;
            promises.push(promise);
            var script = document.createElement('script');
            script.src = chunkId + ".bundle.js";
            document.head.appendChild(script);
        }
        return Promise.all(promises);
    }
    var jsonArray = window["webpackJsonp"] = window["webpackJsonp"] || [];
    jsonArray.push = webpackJsonpCallback;
    return __webpack_require__("./src/index.js");
})({
    "./src/index.js":
        (function (module, exports, __webpack_require__) {
            var button = document.createElement("button");
            button.innerHTML = "点我";
            button.onclick = function () {
                __webpack_require__.e("title").then(__webpack_require__.t.bind(null, "./src/title.js", 7)).then(function (result) {
                    console.log(result["default"]);
                });
            };
            document.body.appendChild(button);
        })
})
```