1. 使用Fragment

- `Fragment`可以让你聚合一个子元素列表,并且不在DOM中增加额外节点
- `Fragment` 看起来像空的 `JSX` 标签

1.1 index.js

```
import React from 'react';
import ReactDOM from 'react-dom';
import Table from './components/Table';
let data = [
    {id:1,name:'zhufeng',age:10},
    {id:2,name:'jiagou',age:10}
]
ReactDOM.render(<Table data={data} />, document.getElementById('root'));
```

1.2 Table.js

src\components\Table.js

```
import React from "react";
class Columns extends React.Component {
  render() {
    let data = this.props.data;
    //Adjacent JSX elements must be wrapped in an enclosing tag. Did you want a
JSX fragment <>...</>
    return (
        <><td>{data.id}</td><td>{data.name}</td><td>{data.age}</td></>
    )
  }
}
export default class Table extends React.Component {
  render() {
    return (
      <table>
        <thead>
          <tr>
            <td>ID</td>
```

```
            <td>Name</td>
            <td>Age</td>
          </tr>
        </thead>
        <tbody>
          {
            this.props.data.map((item, index) => (
             <tr key={index}>
              <Columns data={item} />
             </tr>
            ))
          }
        </tbody>
      </table>
    );
  }
}
```

2. PureComponent

- 当一个组件的 `props` 或 `state` 变更，`React` 会将最新返回的元素与之前渲染的元素进行对比，以此决定是否有必要更新真实的 DOM，当它们不相同时 React 会更新该 DOM
- 如果渲染的组件非常多时可以通过覆盖生命周期方法 `shouldComponentUpdate` 来进行优化
- `shouldComponentUpdate` 方法会在重新渲染前被触发。其默认实现是返回 true,如果组件不需要更新，可以在 `shouldComponentUpdate` 中返回 `false` 来跳过整个渲染过程。其包括该组件的 `render` 调用以及之后的操作

2.1 重复渲染

```
import React, { Component } from 'react';
import ReactDOM from 'react-dom';

class App extends Component{
  state = {counter:{number:0}}
  add = ()=>{
      let oldState = this.state;
      let amount = parseInt(this.amount.value);
      let newState = {...oldState,counter:amount==0?oldState.counter:
{number:oldState.counter.number+amount}};
      this.setState(newState);
  }
  render(){
    console.log('App render');
    return (
      <div>
        <Counter counter={this.state.counter}/>
        <input ref={inst=>this.amount = inst}/>
        <button onClick={this.add}>+</button>
      </div>
    )
  }
}
class Counter extends React.Component{
  render(){
    console.log('Counter render');
```

```
    return (
     <p>{this.props.counter.number}</p>
    )
  }
}

ReactDOM.render(
    <App />,
    document.getElementById('root')
)
```

2.2 PureComponent

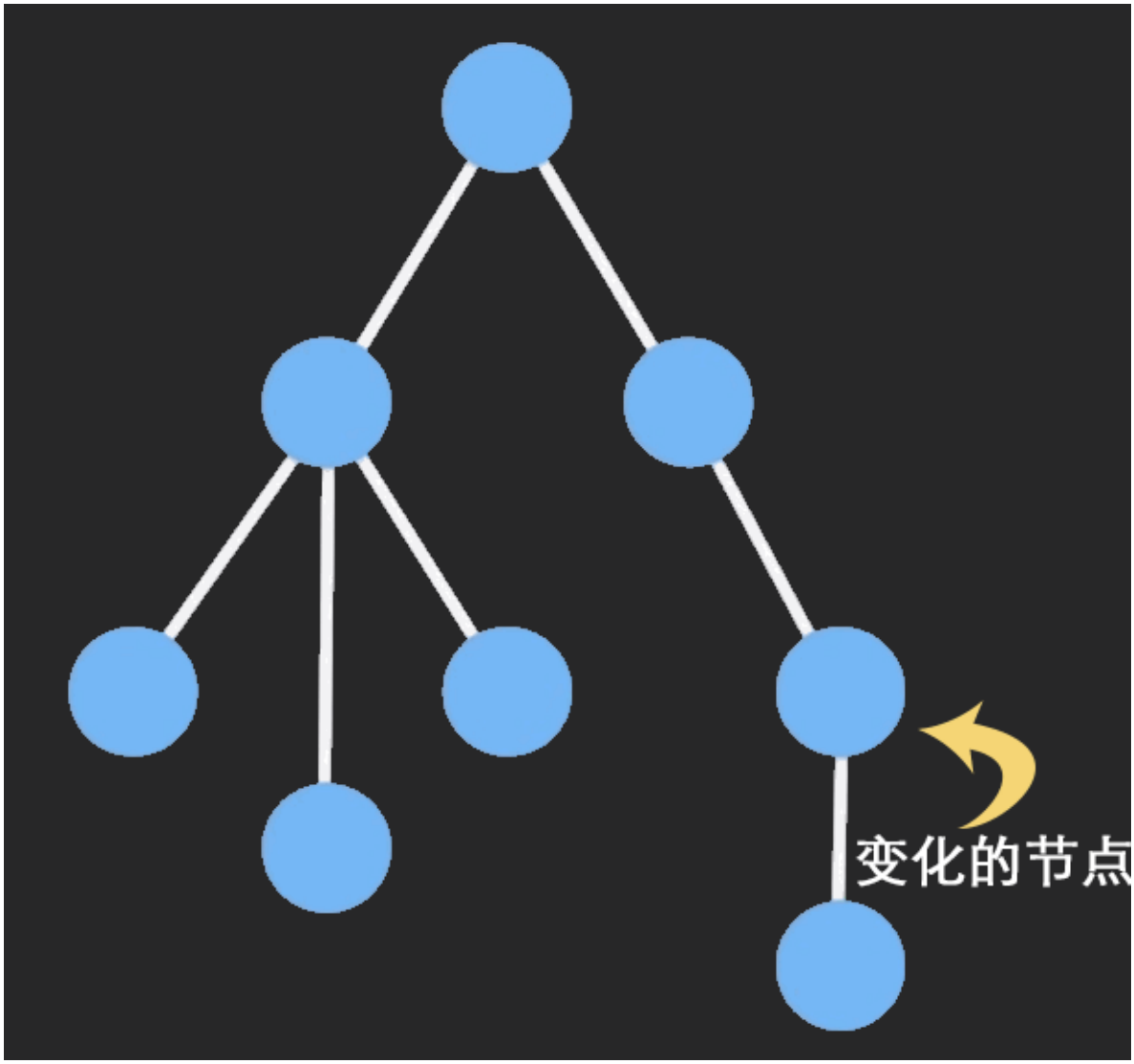
- React15.3 中新加了一个类 `PureComponent`,它会在 `render` 之前帮组件自动执行一次 `shallowEqual` （浅比较），来决定是否更新组件
- `PureComponent` 通过 `prop` 和 `state` 的浅比较来实现 `shouldComponentUpdate`

```
import React, { Component } from "react";
import ReactDOM from "react-dom";
+class PureComponent extends Component {
+  shouldComponentUpdate(newProps) {
+    return !shallowEqual(this.props, newProps);
+  }
+}
+function shallowEqual(obj1, obj2) {
+  if (obj1 === obj2) {
+    return true;
+  }
+  if (typeof obj1 != "object" ||obj1 === null ||typeof obj2 != "object" ||obj2
=== null) {
+    return false;
+  }
+  let keys1 = Object.keys(obj1);
+  let keys2 = Object.keys(obj2);
+  if (keys1.length != keys2.length) {
+    return false;
+  }
+  for (let key of keys1) {
+    if (!obj2.hasOwnProperty(key) || obj1[key] !== obj2[key]) {
+      return false;
+    }
+  }
+  return true;
+}
class App extends Component {
  state = { counter: { number: 0 } };
  add = () => {
    let oldState = this.state;
    let amount = parseInt(this.amount.value);
    let newState = {
      ...oldState,
      counter:
        amount == 0
          ? oldState.counter
          : { number: oldState.counter.number + amount }
    };
```

```
    this.setState(newState);
  };
  render() {
    console.log("App render");
    return (
      <div>
        <Counter counter={this.state.counter} />
        <input ref={inst => (this.amount = inst)} />
        <button onClick={this.add}>+</button>
      </div>
    );
  }
}
+class Counter extends PureComponent {
  render() {
    console.log("Counter render");
    return <p>{this.props.counter.number}</p>;
  }
}

ReactDOM.render(<App />, document.getElementById("root"));
```

2.3 PureComponent+Immutable.js

- Immutable.js是 Facebook 在 2014 年出的持久性数据结构的库
- `Immutable Data` 就是一旦创建，就不能再被更改的数据。对 Immutable 对象的任何修改或添加删除操作都会返回一个新的 Immutable 对象一个新的 `Immutable` 对象
- Immutable 实现的原理是 `Persistent Data Structure`（持久化数据结构），也就是使用旧数据创建新数据时，要保证旧数据同时可用且不变,同时为了避免 `deepCopy` 把所有节点都复制一遍带来的性能损耗
- Immutable 使用了 Structural Sharing（结构共享），即如果对象树中一个节点发生变化，只修改这个节点和受它影响的父节点，其它节点则进行共享



2.4.1 immutable

- immutable-js内部实现了一套完整的 Persistent Data Structure,还有很多易用的数据类型。像 `Collection`、`List`、`Map`、`Set`、`Record`、`Seq`

2.4.1.1 安装

```
cnpm install immutable -S
```

2.4.1.2 使用

```
let { Map } = require("immutable");
const map1 = Map({ a: { aa: 1 }, b: 2, c: 3 });
const map2 = map1.set('b', 50);
console.log(map1 !== map2); // true
console.log(map1.get('b')); // 2
console.log(map2.get('b')); // 50
console.log(map1.get('a') === map2.get('a')); // true
```

2.4.1.3 重构

```
import React, { Component } from "react";
import ReactDOM from "react-dom";
+ import { Map,is } from "immutable";
class PureComponent extends Component {
```

```
  shouldComponentUpdate(newProps) {
    return !shallowEqual(this.props, newProps);
  }
}
function shallowEqual(obj1, obj2) {
  if (obj1 === obj2) {
    return true;
  }
  if (typeof obj1 != "object" ||obj1 === null ||typeof obj2 != "object" ||obj2
=== null) {
    return false;
  }
  let keys1 = Object.keys(obj1);
  let keys2 = Object.keys(obj2);
  if (keys1.length != keys2.length) {
    return false;
  }
  for (let key of keys1) {
+     if (!obj2.hasOwnProperty(key) || !is(obj1[key],obj2[key])) {
      return false;
    }
  }
  return true;
}
class App extends Component {
+   state = { counter: Map({ number: 0 }) };
  add = () => {
    /**
    let oldState = this.state;
    let amount = parseInt(this.amount.value);
    this.setState({counter:{ number: oldState.counter.number + amount }});
    */
+     this.state.counter =
this.state.counter.set('number',this.state.counter.get('number') +
parseInt(this.amount.value));
+     this.setState(this.state);
  };
  render() {
    console.log("App render");
    return (
      <div>
        <Counter counter={this.state.counter} />
        <input ref={inst => (this.amount = inst)} />
        <button onClick={this.add}>+</button>
      </div>
    );
  }
}
class Counter extends PureComponent {
  render() {
    console.log("Counter render");
    return <p>{this.props.counter.number}</p>;
  }
}

ReactDOM.render(<App />, document.getElementById("root"));
```

3. memo

- `React.memo()`是一个高阶函数，它与`React.PureComponent`类似，但是一个函数组件而非一个类

3.1 `memoization`(memorization)方案

- `memoization`(memorization)方案是一种将函数执行结果用变量缓存起来的方法
- 当函数进行计算之前，先看缓存对象中是否有次计算结果，如果有，就直接从缓存对象中获取结果；如果没有，就进行计算，并将结果保存到缓存对象中

3.2 优化

```
import React, { Component } from "react";
import ReactDOM from "react-dom";
import { Map,is } from "immutable";
class PureComponent extends Component {
  isPureReactComponent = true;
  shouldComponentUpdate(newProps, newState) {
    return (
      !shallowEqual(this.props, newProps)
    );
  }
}
class App extends Component {
  state = { title:'计数器',counter: Map({ number: 0 }) };
  add = () => {
    this.state.counter =
this.state.counter.set('number',this.state.counter.get('number') +
parseInt(this.amount.value));
    this.setState(this.state);
  };
  render() {
    console.log("App render");
    return (
      <div>
+        <Title title={this.props.title}/>
        <Counter counter={this.state.counter} />
        <input ref={inst => (this.amount = inst)} />
        <button onClick={this.add}>+</button>
      </div>
    );
  }
}
+function memo(Func){
+  class Proxy extends PureComponent{
+    render(){
+      return <Func {...this.props}/>
+    }
+  }
+  return Proxy;
+}
+const Title = memo(props=>{
+  console.log('Title render');
+  return  <p>{props.title}</p>;
+});
```

```
class Counter extends PureComponent {
  render() {
    console.log("Counter render");
    return <p>{this.props.counter.get('number')}</p>;
  }
}

ReactDOM.render(<App />, document.getElementById("root"));

function shallowEqual(obj1, obj2) {
  if (obj1 === obj2) {
    return true;
  }
  if (
    typeof obj1 != "object" ||
    obj1 === null ||
    typeof obj2 != "object" ||
    obj2 === null
  ) {
    return false;
  }
  let keys1 = Object.keys(obj1);
  let keys2 = Object.keys(obj2);
  if (keys1.length != keys2.length) {
    return false;
  }
  for (let key of keys1) {
    if (!obj2.hasOwnProperty(key) || !is(obj1[key],obj2[key])) {
      return false;
    }
  }
  return true;
}
```


4. Lazy+Error Boundaries

4.1 React.Lazy

- React.Lazy帮助我们按需加载组件，从而减少我们应用程序的加载时间，因为只加载我们所需的组件。

- React.lazy 接受一个函数，这个函数内部调用 import() 动态导入。它必须返回一个 Promise，该 Promise 需要 resolve 一个 `default export` 的 React 组件
- React.Suspense 用于包装延迟组件以在加载组件时显示后备内容

```
import React, { Component, Suspense } from 'react'
import ReactDOM from 'react-dom';
import Loading from './components/Loading';
function lazy(loadFunction){
   return class LazyComponent extends React.Component{
       state = {Comp:null}
       componentDidMount(){
           loadFunction().then(result=>{
               this.setState({Comp:result.default});
           });
       }
       render(){
           let Comp = this.state.Comp;
           return Comp?<Comp {...this.props}/>:null;
       }
   }
}
const AppTitle  = React.lazy(()=>import(/* webpackChunkName: "title"
*/'./components/Title'))

class App extends Component{
    state = {visible:false}
    show = ()=>{
        this.setState({visible:true});
    }
    render() {
        return (
            <>
             {this.state.visible&&(
                 <Suspense fallback={<Loading/>}>
                    <AppTitle/>
                 </Suspense>
             )}
             <button onClick={this.show}>加载</button>
            </>
        )
    }
}
ReactDOM.render(<App />, document.querySelector('#root'));
```

4.2 错误边界(Error Boundaries)

- 如果当一个组件异步加载下载js文件时，网络错误，无法下载 js 文件
  Suspense 无法处理这种错误情况， 在 react 中有一个 错误边界 （Error Boundaries）的概念，用来解决这种问题，它是利用了 react 生命周期的 `componentDidCatch` 方法来处理
- 有两种方式，一种是 生命周期 componentDidCatch 来处理错误，还有一种 是 静态方法 static getDerivedStateFromError 来处理错误，
- 请使用 `static getDerivedStateFromError()` 渲染备用 UI ，使用 `componentDidCatch()` 打印错误信息。

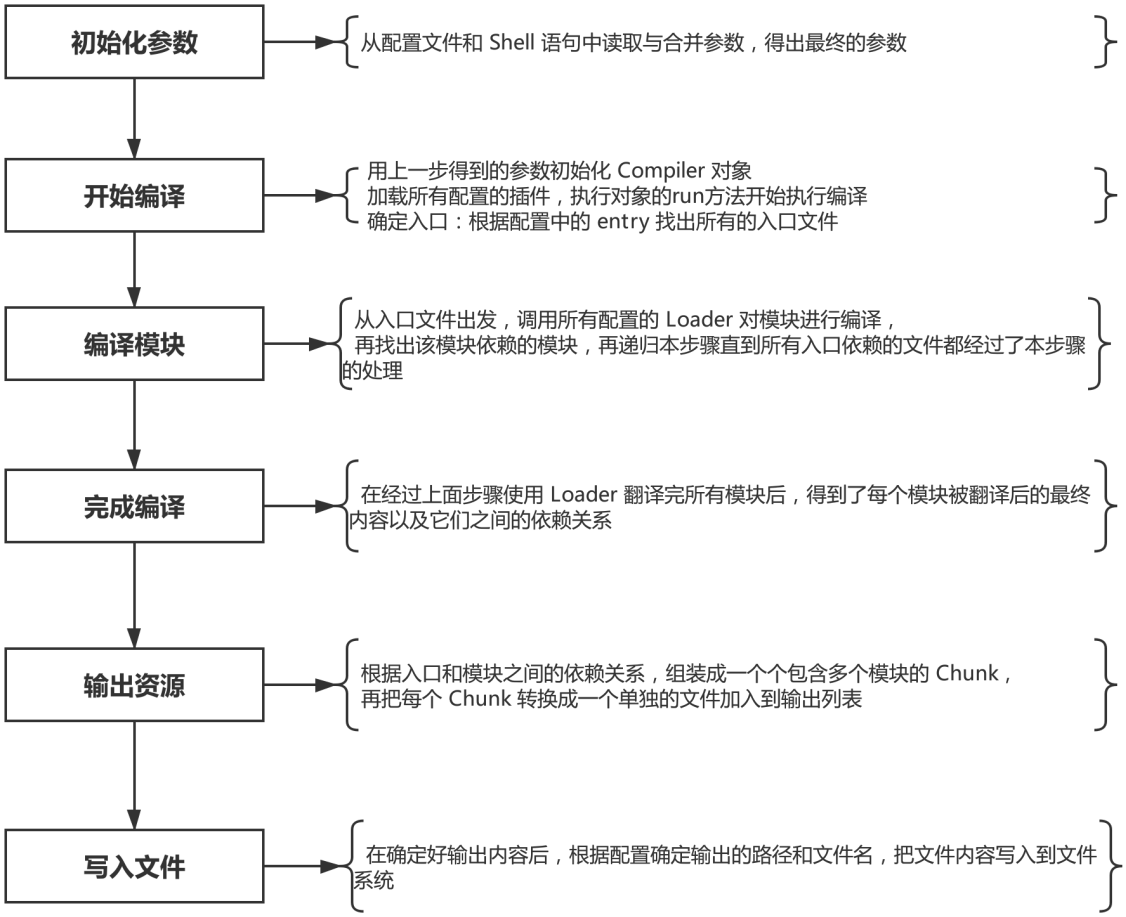
```
import React, { Component, Suspense } from 'react'
```

```
import ReactDOM from 'react-dom';
import Loading from './components/Loading';
+ const AppTitle  = React.lazy(()=>import(/* webpackChunkName: "title"
*/'./components/Title'))

class App extends Component{
+    state = {visible:false,isError: false}
    show = ()=>{
        this.setState({visible:true});
    }

+    static getDerivedStateFromError(error) {
+      return { isError: true };
+    }
+    componentDidCatch (err, info) {
+      console.log(err, info)
+    }
    render() {
        if (this.state.isError) {
            return (<div>error</div>)
        }
        return (
            <>
             {this.state.visible&&(
                 <Suspense fallback={<Loading/>}>
                    <AppTitle/>
                 </Suspense>
             )}
             <button onClick={this.show}>加载</button>
            </>
        )
    }
}
ReactDOM.render(<App />, document.querySelector('#root'));
```

5. 骨架屏

- Skeleton Screen(骨架屏)就是在页面数据尚未加载前先给用户展示出页面的大致结构，直到请求数据返回后再渲染页面，补充进需要显示的数据内容。常用于文章列表、动态列表页。
- react-content-loader SVG-Powered component to easily create placeholder loadings
- create-content-loader
- react-skeleton-webpack-plugin is a Webpack plugin based on React which generates Skeleton Screen for SPA

```
cnpm i @babel/core @babel/plugin-proposal-class-properties @babel/plugin-
proposal-decorators @babel/preset-env @babel/preset-react babel-loader  html-
webpack-plugin webpack webpack-cli webpack-dev-server webpack-merge webpack-
node-externals memory-fs require-from-string   react-content-loader react-
router-dom prerender-spa-plugin react-lazyload react-window immutable -D

npx webpack --config webpack.skeleton.js
npx webpack
```



在以上过程中，Webpack 会在特定的时间点广播出特定的事件，插件在监听到感兴趣的事件后会执行特定的逻辑，并且插件可以调用 Webpack 提供的 API 改变 Webpack 的运行结果

5.1 skeleton.js

src\skeleton.js

```
import React from 'react';
import ReactDOM from 'react-dom';
import ReactDOMServer from 'react-dom/server';
import ContentLoader from 'react-content-loader';
export default ReactDOMServer.renderToStaticMarkup(<ContentLoader />);
```

5.2 index.js

src\index.js

```
import React from "react";
import ReactDOM from "react-dom";
let style = { width: "100%", height: "300px", backgroundColor: "orange" };
setTimeout(() => {
    ReactDOM.render(<div style={style}></div>, document.getElementById("root"));
}, 2000);
```

5.3 index.html

src\index.html

```
<!DOCTYPE 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>Document</title>
</head>
<body>
    <div id="root"></div>
</body>
</html>
```

5.4 webpack.base.js

webpack.base.js

```
const path = require('path');
module.exports = {
  mode:'development',
  devtool:"none",
  context: process.cwd(),
  output: {
    path: path.resolve(__dirname, "dist")
  },
  module: {
    rules: [
      {
        test: /\.jsx?$/,
        use: {
          loader: "babel-loader",
          options: {
            presets: ["@babel/preset-env","@babel/preset-react"],
            plugins: [
              ["@babel/plugin-proposal-decorators", { legacy: true }],
              ["@babel/plugin-proposal-class-properties", { loose: true }]
            ]
          }
        },
        include: path.join(__dirname, "src"),
        exclude: /node_modules/
      }
    ]
  }
};
```

5.5 webpack.skeleton.js

webpack.skeleton.js

- targets

```
const path = require("path");
const HtmlWebpackPlugin = require("html-webpack-plugin");
```

```
const { smart } = require("webpack-merge");
const base = require("./webpack.base");
const nodeExternals = require('webpack-node-externals');
module.exports = smart(base, {
  target: 'node',
  mode: "development",
  context: process.cwd(),
  entry: "./src/skeleton.js",
  output:{
    filename:'skeleton.js',
    libraryTarget: 'commonjs2'
  },
  externals: nodeExternals()
});
```

5.6 webpack.config.js

webpack.config.js

```
const path = require("path");
const HtmlWebpackPlugin = require("html-webpack-plugin");
const { smart } = require("webpack-merge");
const base = require("./webpack.base");
const SkeletonWebpackPlugin = require('./SkeletonWebpackPlugin');
module.exports = smart(base, {
  mode: "development",
  context: process.cwd(),
  entry: {main:"./src/index.js"},
  output:{
    filename:'main.js'
  },
  plugins: [
    new HtmlWebpackPlugin({
      template: "./src/index.html", //指定模板文件
      filename: "index.html" //产出后的文件名
    }),
    new SkeletonWebpackPlugin({
        webpackConfig: require('./webpack.skeleton')
    })
  ]
});
```

5.7 SkeletonWebpackPlugin.js

SkeletonWebpackPlugin.js

- memory-fs is a simple `in-memory` filesystem
- require-from-string Load module from string in Node.
- html-webpack-plugin

```
let requireFromString = require('require-from-string');
let result = requireFromString('module.exports = "hello"');
console.log(result);// hello
```

```
let webpack = require("webpack");
```

```
let path = require('path');
let MFS = require("memory-fs");
var requireFromString = require("require-from-string");
let mfs = new MFS();
class SkeletonPlugin {
  constructor(options) {
    this.options = options;
  }
  apply(compiler) {
    let { webpackConfig } = this.options;
    compiler.hooks.compilation.tap("SkeletonPlugin", compilation => {
      compilation.hooks.htmlWebpackPluginBeforeHtmlProcessing.tapAsync(
        "SkeletonPlugin",
        (htmlPluginData, callback) => {
          let outputPath =
path.join(webpackConfig.output.path,webpackConfig.output.filename);
          let childCompiler = webpack(webpackConfig);
          childCompiler.outputFileSystem = mfs;
          childCompiler.run((err, stats) => {
            let skeleton= mfs.readFileSync(outputPath, "utf8");
            let skeletonHtml = requireFromString(skeleton);
            if (skeletonHtml.default) {
              skeletonHtml = skeletonHtml.default;
            }
            htmlPluginData.html=htmlPluginData.html.replace(`<div id="root">
</div>`,`<div id="root">${skeletonHtml}</div>`);
            callback(null, htmlPluginData);
          });
        }
      );
    });
  }
}
module.exports = SkeletonPlugin;
```


6. 预渲染

- 由于SPA项目普通的爬虫无法爬取项目的静态文本的内容，通过预渲染插件[prerender-spa-plugin(https://github.com/chrisvfritz/prerender-spa-plugin)解决SPA项目的SEO问题
- `prerender-spa-plugin` 利用了 `Puppeteer` 的爬取页面的功能。

- `Puppeteer` 是一个 Chrome官方出品的 `headless Chrome node` 库。它提供了一系列的 API, 可以在无 UI 的情况下调用 Chrome 的功能, 适用于爬虫、自动化处理等各种场景
- 原理是在 `Webpack` 构建阶段的最后，在本地启动一个 `Puppeteer` 的服务，访问配置了预渲染的路由，然后将 `Puppeteer` 中渲染的页面输出到 HTML 文件中，并建立路由对应的目录

6.1 src\index.js

src\index.js

```
import React from 'react';
import ReactDOM from 'react-dom';
import {BrowserRouter as Router,Route,Link} from 'react-router-dom';
let  Home = props=><div>Home</div>
let User = props=><div>User</div>
let Profile = props=><div>Profile</div>
ReactDOM.render(
    <Router>
        <>
          <Link to="/">home</Link>
          <Link to="/user">user</Link>
          <Link to="/profile">profile</Link>
          <Route path="/" exact={true} component={Home} />
          <Route path="/user" component={User} />
          <Route path="/profile" component={Profile}/>
        </>
    </Router>
,document.getElementById('root'));
```

6.2 src\index.html

src\index.html

```
<!DOCTYPE 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>Document</title>
</head>
<body>
    <div id="root"></div>
</body>
</html>
```

6.3 webpack.config.js

webpack.config.js

```
const path = require("path");
const HtmlWebpackPlugin = require("html-webpack-plugin");
const PrerenderSPAPlugin = require("./prerender-spa-plugin");

module.exports = {
  mode: "development",
```

```
  context: process.cwd(),
  entry: "./src/index.js",
  output: {
    path: path.resolve(__dirname, "dist"),
    filename: "bundle.js"
  },
  module: {
    rules: [
      {
        test: /\.jsx?$/,
        use: {
          loader: "babel-loader",
          options: {
            presets: ["@babel/preset-env", "@babel/preset-react"],
            plugins: [
              ["@babel/plugin-proposal-decorators", { legacy: true }],
              ["@babel/plugin-proposal-class-properties", { loose: true }]
            ]
          }
        },
        include: path.join(__dirname, "src"),
        exclude: /node_modules/
      }
    ]
  },
  plugins: [
    new HtmlWebpackPlugin({
      template: "./src/index.html", //指定模板文件
      filename: "index.html" //产出后的文件名
    }),
     new PrerenderSPAPlugin({
      staticDir: path.join(__dirname, "dist"),
      routes: ["/","/user","/profile"]
    })
  ]
};
```

6.4 prerender-spa-plugin.js

prerender-spa-plugin.js

```
const path = require("path");
const Prerenderer = require("@prerenderer/prerenderer");
const PuppeteerRenderer = require("@prerenderer/renderer-puppeteer");
class PrerenderSPAPlugin {
  constructor(options) {
    this._options = options;
    this._options.renderer = new PuppeteerRenderer({ headless: true });
  }
  apply(compiler) {
    let _this = this;
    const compilerFS = compiler.outputFileSystem;
    const afterEmit = (compilation, done) => {
      const PrerendererInstance = new Prerenderer(_this._options);
      PrerendererInstance.initialize()
        .then(() => {
          return PrerendererInstance.renderRoutes(_this._options.routes || []);
```

```
        })
        .then(renderedRoutes => {
          let promises = renderedRoutes.map(rendered => {
            return new Promise(function(resolve) {
              rendered.outputPath = path.join(
                _this._options.staticDir,
                rendered.route,
                "index.html"
              );
              let dir = path.dirname(rendered.outputPath);
              compilerFS.mkdirp(dir, (err, made) => {
                compilerFS.writeFile(
                  rendered.outputPath,
                  rendered.html,
                  err => {
                    resolve();
                  }
                );
              });
            });
          });
          return Promise.all(promises);
        })
        .then(() => {
          PrerendererInstance.destroy();
          done();
        });
    };
    compiler.hooks.afterEmit.tapAsync("PrerenderSPAPlugin", afterEmit);
  }
}
module.exports = PrerenderSPAPlugin;
```

> 不适合不同的用户看都会不同的页面，这种类型的页面不适用预渲染
> 对于一些经常发生变化的页面，如体育比赛等，会导致编译后的数据不是实时更新的

7. 图片懒加载

- react-lazyload
- lazyimages.zip

7.1 webpack.config.js

webpack.config.js

```
const path = require('path');
const HtmlWebpackPlugin=require('html-webpack-plugin');
module.exports = {
  mode:'development',
  context: process.cwd(),
  entry: "./src/index.js",
  output: {
    path: path.resolve(__dirname, "dist"),
    filename: "bundle.js"
  },
  module: {
```

```
    rules: [
      {
        test: /\.jsx?$/,
        use: {
          loader: "babel-loader",
          options: {
            presets: ["@babel/preset-env","@babel/preset-react"],
            plugins: [
              ["@babel/plugin-proposal-decorators", { legacy: true }],
              ["@babel/plugin-proposal-class-properties", { loose: true }]
            ]
          }
        },
        include: path.join(__dirname, "src"),
        exclude: /node_modules/
      },
      {
        test:/\.(jpg|png|gif)$/,
        use:{loader:'url-loader',options:{limit:0}}
      },
      {
        test:/\.css$/,
        use:["style-loader",'css-loader']
      }
    ]
  },
  plugins: [
       new HtmlWebpackPlugin({
            template:'./src/index.html',//指定模板文件
            filename:'index.html',//产出后的文件名
        })
  ]
};
```

7.2 index.js

src\index.js

```
import React from "react";
import ReactDOM from "react-dom";
import './index.css';
import LazyLoad from "./react-lazyload";
const App = (props) => {
  return (
    <ul className="list" style={{overflow:'auto'}}>
     {
        props.images.map((image,index)=>(
            <LazyLoad key={index} height={200} >
               <li> <img src={image} /></li>
            </LazyLoad>
        ))
     }
    </ul>
  );
};
let images = [
    require('./images/1.jpg'),
```

```
    require('./images/2.jpg'),
    require('./images/3.jpg'),
    require('./images/4.jpg'),
    require('./images/5.jpg'),
    require('./images/6.jpg'),
    require('./images/7.jpg'),
    require('./images/8.jpg'),
]

ReactDOM.render(<App images={images}/>, document.getElementById("root"));
```

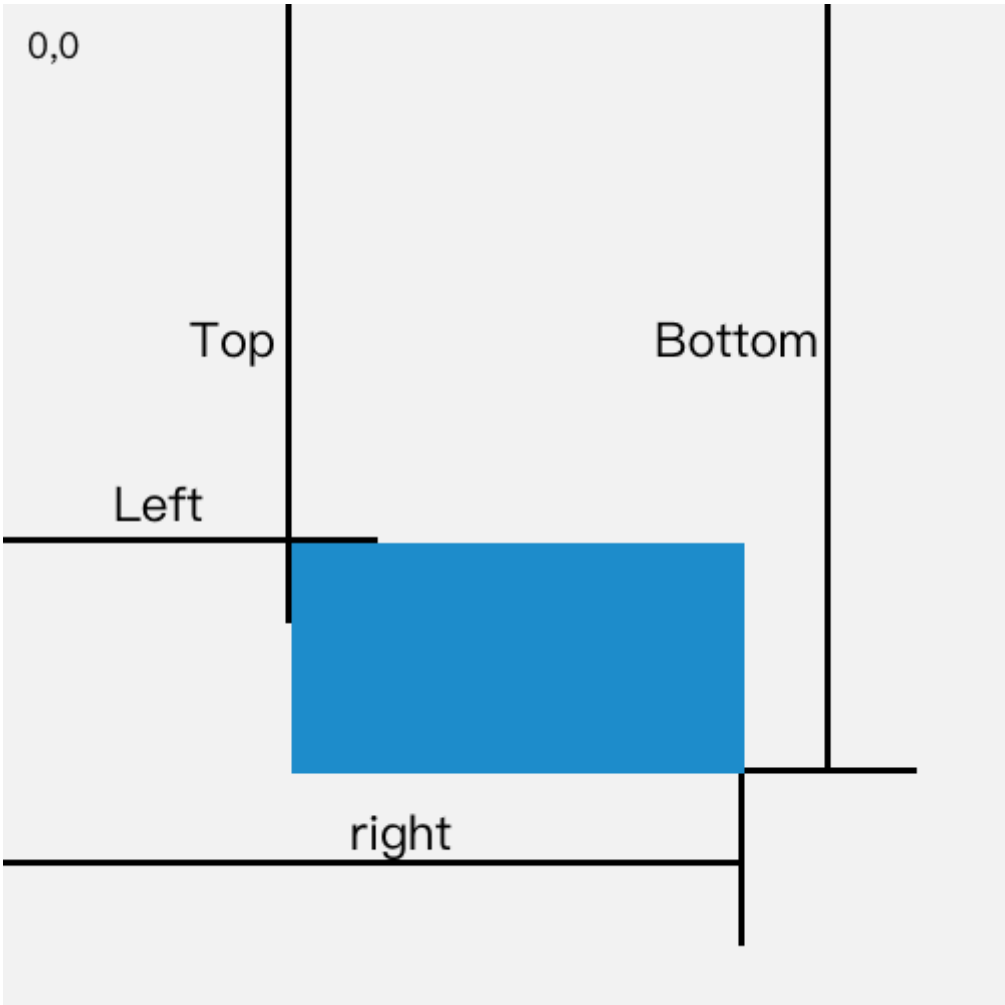
7.3 index.css

src\index.css

```
*{
    margin: 0;
    padding: 0;
}
ul,li{
    list-style: none;
}
li img{
    width:100%;
    height:100%;
}
```

7.4 react-lazyload.js

- getBoundingClientRect返回值是一个 DOMRect 对象，这个对象是由该元素的 `getClientRects()` 方法返回的一组矩形的集合, 即：是与该元素相关的CSS 边框集合
- DOMRect 对象包含了一组用于描述边框的只读属性——left、top、right和bottom，单位为像素。除了 width 和 height 外的属性都是相对于视口的左上角位置而言的



src\react-lazyload.js

```
import React from "react";
import ReactDOM from "react-dom";
let listeners = [];
let lazyLoadHandler = () => {
  for (var i = 0; i < listeners.length; ++i) {
    var listener = listeners[i];
    checkVisible(listener);
  }
};
let checkVisible = component => {
  let node = ReactDOM.findDOMNode(component);
  let { top } = node.getBoundingClientRect();
  let visible = top <= (window.innerHeight ||
document.documentElement.clientHeight);
  if (visible) {
    listeners = listeners.filter(item => item != component);
    component.setState({visible});
  }
};
class LazyLoad extends React.Component {
  state = {visible:false}
  constructor(props) {
    super(props);
    this.divRef = React.createRef();
  }
  componentDidMount() {
    if (listeners.length == 0) {
```

```
      window.addEventListener("scroll", lazyLoadHandler);
    }
    listeners.push(this);
    checkVisible(this);
  }
  render() {
    return this.state.visible ? (
      this.props.children
    ) : (
      <div
        style={{ height: this.props.height }}
        className="lazyload-placeholder"
        ref={this.divRef}
      />
    );
  }
}
export default LazyLoad;
```

8. 长列表优化

- 用数组保存所有列表元素的位置，只渲染可视区内的列表元素，当可视区滚动时，根据滚动的offset大小以及所有列表元素的位置，计算在可视区应该渲染哪些元素
- react-window
- fixed-size
- react-virtualized

8.1 index.js

index.js

```
import React, { Component, lazy, Suspense } from "react";
import ReactDOM from "react-dom";
import { FixedSizeList as List } from './react-window';
import './index.css'
const Row = ({ index, style }) => {
  return <div key={index} style=
{{...style,backgroundColor:getRandomColor(),lineHeight:'30px',textAlign:'center'
}}>Row {index+1}</div>
};

const Container = () => (
  <List
    height={150}
    itemCount={100}
    itemSize={30}
    width={'100%'}
  >
    {Row}
  </List>
);
ReactDOM.render(<Container/>, document.querySelector("#root"));
function getRandomColor( ) {
    var rand = Math.floor(Math.random( ) * 0xFFFFFF).toString(16).toUpperCase();
    if(rand.length == 6){
        return '#'+rand;
```

```
    }else{
        return getRandomColor();
    }
}
```

8.2 index.css

index.css

```
*{
    margin: 0;
    padding: 0;
}
ul,li{
    list-style: none;
}
```

8.3 react-window.js

react-window.js

```
import React, { Component} from "react";
export class FixedSizeList extends React.Component{
    state = {start:0}
    constructor(){
        super();
        this.containerRef = React.createRef();
    }
    componentDidMount(){
        this.containerRef.current.addEventListener('scroll',()=>{
            let scrollTop = this.containerRef.current.scrollTop;
            let start = Math.floor(scrollTop/this.props.itemSize);//起始的索引
            this.setState({start});
        });
    }
    render(){
        let {width,height,itemCount,itemSize} = this.props;
        let children = [];
        let size = Math.floor(height/itemSize)+1;//每页的条数
        let itemStyle =
{height:itemSize,width:'100%',position:'absolute',left:0,top:0};
        for(let index=this.state.start;index<this.state.start+size;index++){
            let style = {...itemStyle,top:(index)*itemSize};
            children.push(this.props.children({index,style}));
        }
        let containerStyle =
{height,width:width||'100%',position:'relative',overflow:'auto'};
        return (
            <div style={containerStyle} ref={this.containerRef}>
                <div style={{width:'100%',height:itemSize*itemCount}}>
                    {children}
                </div>
            </div>
        )
    }
}
```

9. key的优化

9.1 diff策略

- DOM节点跨节点层级移动可以忽略
- 相同类型的组件生成相似的结构，不同类型的组件生成不同的结构
- 对于同一层次的子节点可以通过唯一的key进行区分

9.2 tree diff

- 对树进行分层比较，两棵树只会对同一层次节点进行比较
- 当出现跨层级移动时，并不会出现移动操作，而是直接删除重建

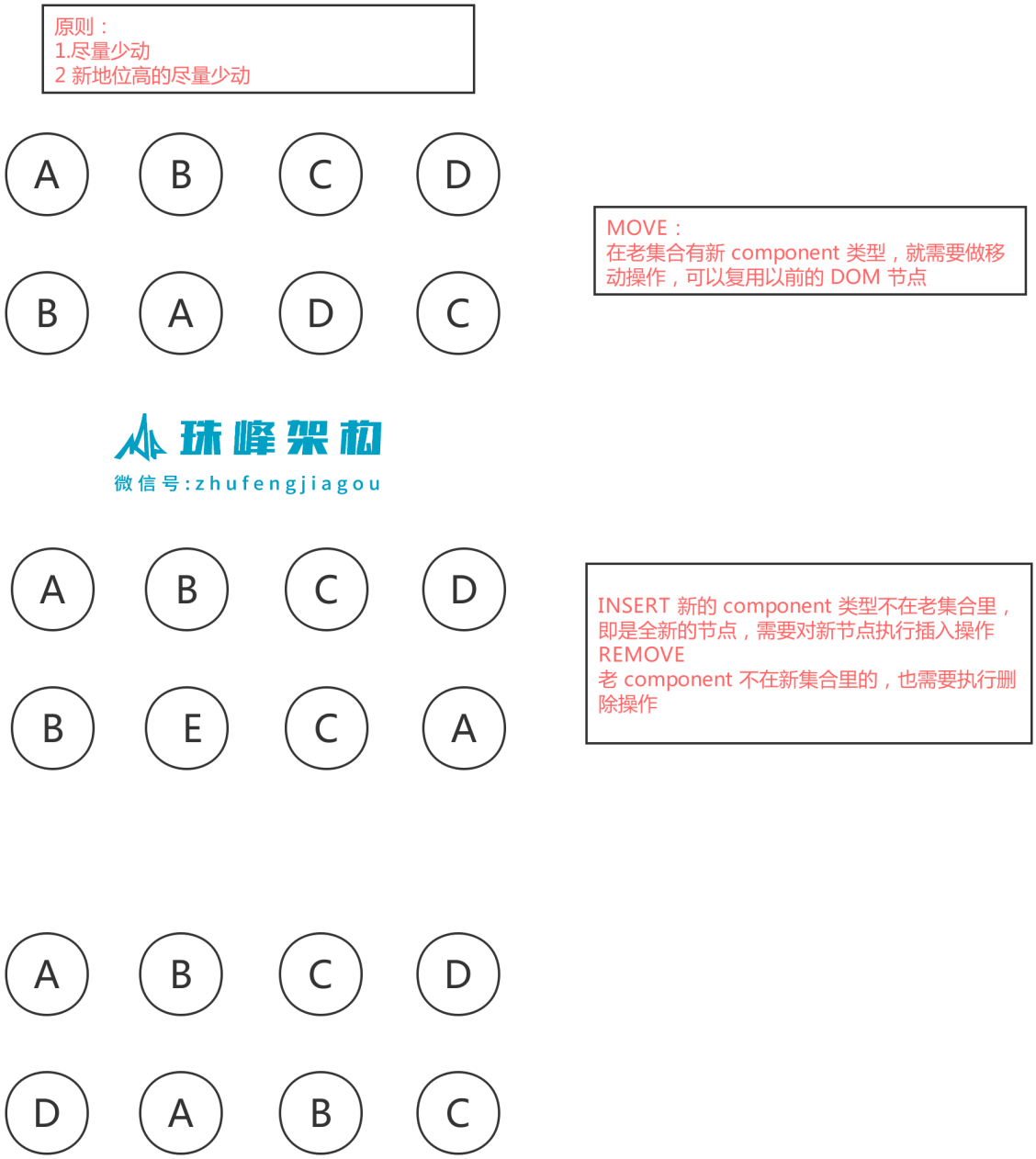
9.3 组件diff

- 如果是同一个类型的组件，会向下继续比较子节点
- 如果类型不同，则替换组件下的所有子节点

9.4 element diff

当节点处于同一层级时，`React diff` 提供了三种节点操作,分别为：INSERT(插入)、MOVE(移动)和REMOVE(删除)

- INSERT: 新的 `component` 类型不在老集合里， 即是全新的节点，需要对新节点执行插入操作
- MOVE: 在老集合有新 `component` 类型，就需要做移动操作，可以复用以前的 DOM 节点
- REMOVE: 老 `component` 不在新集合里的，也需要执行删除操作



10. React 性能分析器

- [introducing-the-react-profiler]
- React 16.5 增加了对新的开发者工具 DevTools 性能分析插件的支持
- 此插件使用 React 实验性的 Profiler API 来收集有关每个组件渲染的用时信息，以便识别 React 应用程序中的性能瓶颈

10.1 分析解析

- 分析一个应用程序的性能（Profiling an application）
- 查看性能数据(render(渲染)阶段和commit(提交)阶段)
- 过滤 commits（Filtering commits）
- 火焰图表（Flame chart）
- 排序图表（Ranked chart）
- 组件图表（Component chart）
- 交互（Interactions）

10.2 react-flame-graph

- react-flame-graph是用来可视化性能数据的React组件