云计算与大数据应用开发

第七章：云计算应用开发（二）

丁烨
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计算机科学与技术学院

2024-05-20

東莞理工學院
DONGGUAN UNIVERSITY OF TECHNOLOGY

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1 前端技术概述

2 Vue.js

3 连接 UI 和 API

4 常见的 UI 组件库

REST 应用程序架构

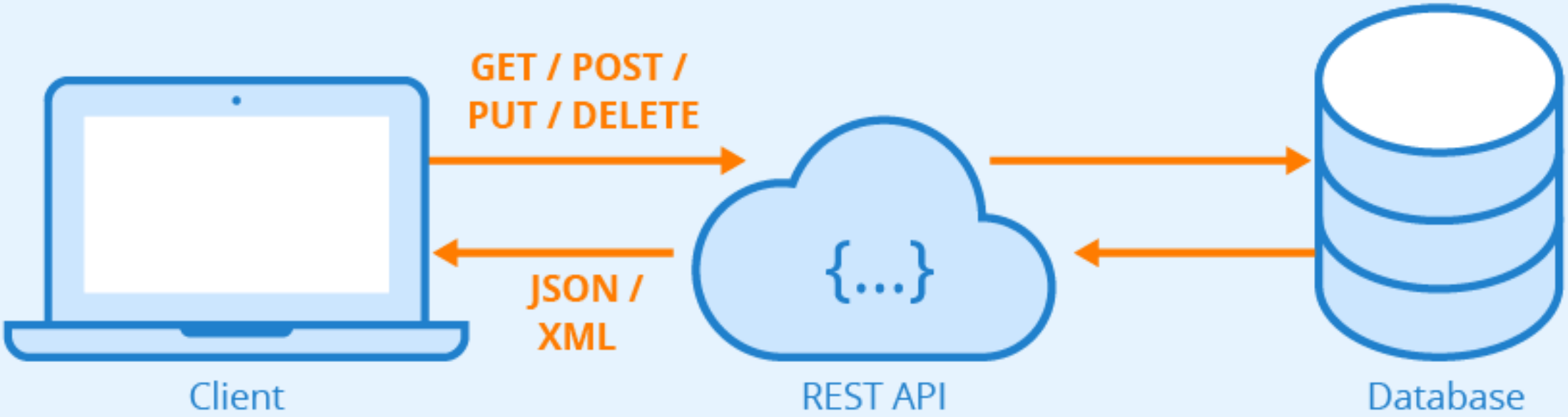
- 表现层状态转换（Representational State Transfer，REST）
- 由 Roy Thomas Fielding 于 2000 年提出来的一种互联网应用程序架构
- 目的是便于不同应用程序在互联网中互相传递信息
- 允许客户端发出统一的、无状态的资源标识符访问和操作网络资源
- 相对于其它种类的互联网应用程序架构，例如 SOAP（Simple Object Access Protocol），REST 的无状态特性降低了多平台应用程序的开发强度
- REST 是目前 SaaS 的主流技术架构

REST 应用程序架构

- 接口统一
- 客户端和服务端通常为 JSON 或 XML
- 服务端和数据库通常为 ORM

- 无状态
- 如有需要，客户端每次服务请求都需要携带验证信息
- 服务端每次数据请求都需要携带验证信息

REST 应用程序架构



REST 应用程序架构

- REST 的优势
- 客户端、服务端、数据库可以任选架构，只要接口统一即可
- 客户端包括：PC 网页端、移动网页端，Windows / Mac / Linux 桌面应用程序、Android / iOS 移动端应用程序、微信小程序等
- 数据库包括：RDBMS 数据库，如 SQLite、MySQL、PostgreSQL、Oracle 等；NoSQL 数据库，如 Redis、MongoDB、Impala、Cassandra、HBase 等
- 服务端：即“应用程序接口”

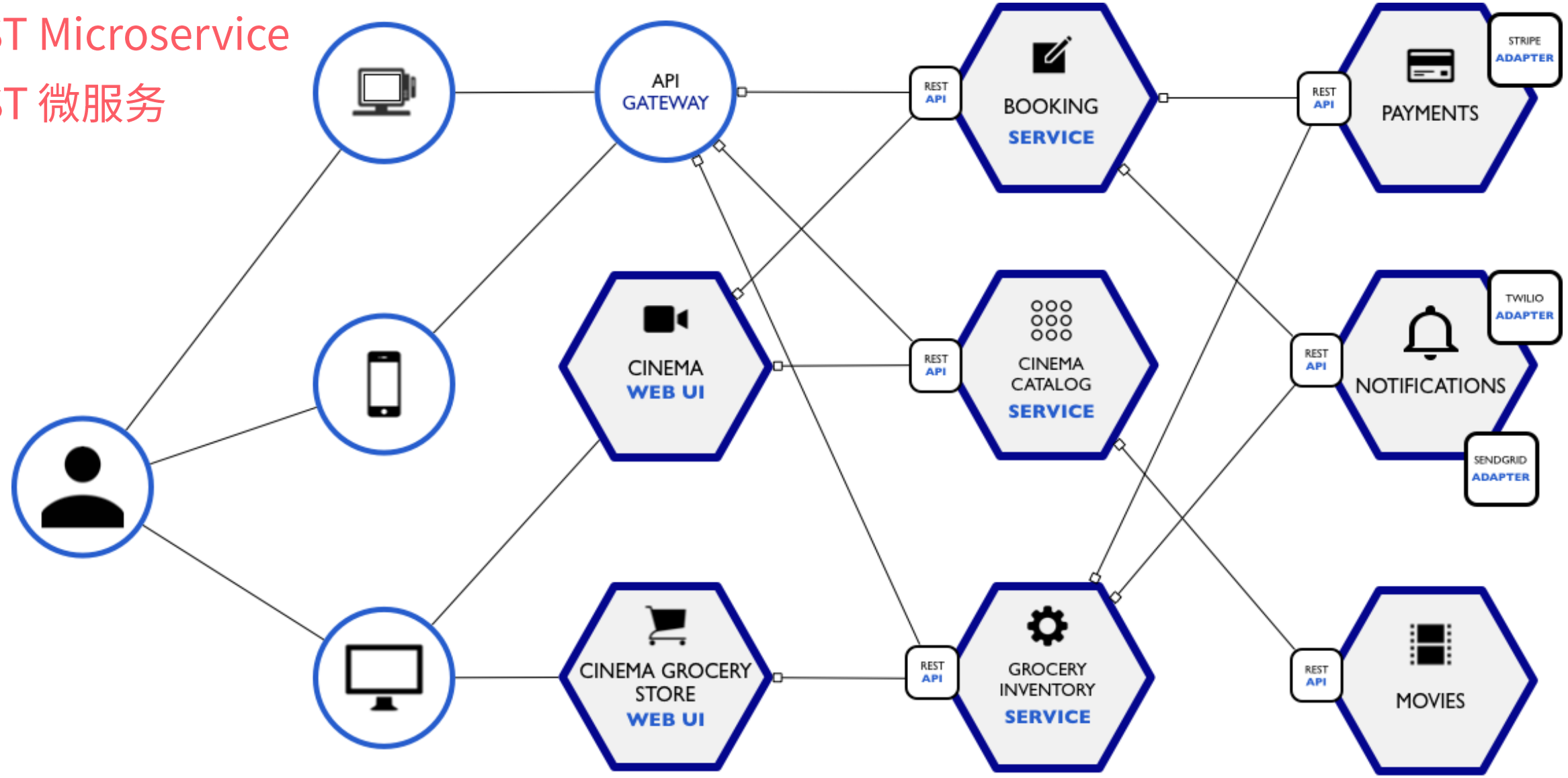
- 不同的组件可以选择不同的运行环境，包括操作系统和硬件
- 不同的组件可以同时运行（例如，一个用户可以同时使用手机和电脑登陆“微信”）
- 只要接口统一即可

REST 应用程序架构

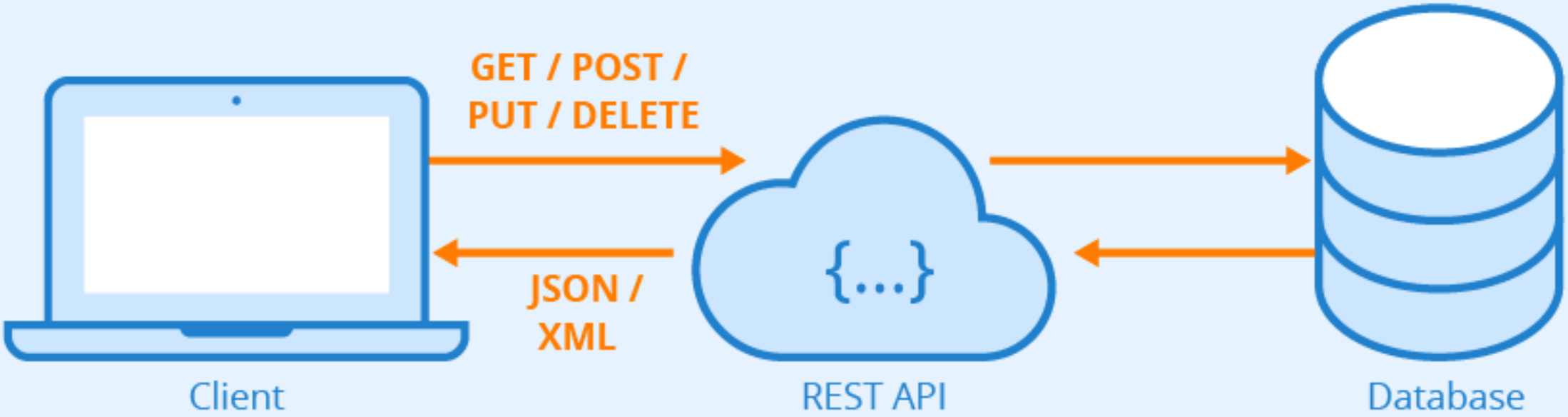
- REST 的优势
- REST 架构非常适合云计算时代的互联网应用
- 为了适应用户需求，大部分应用程序都包含不止一个终端
- REST 架构使得应用开发完全分离：前端工程师、后端工程师、数据库工程师
- Docker 为 REST 架构提供了非常方便的部署方案
- 在 REST 架构中，每个组件都可以非常方便的扩大服务规模（Scale Up）或减小服务规模（Scale Down）

REST 应用程序架构

- REST Microservice
- REST 微服务



REST UI



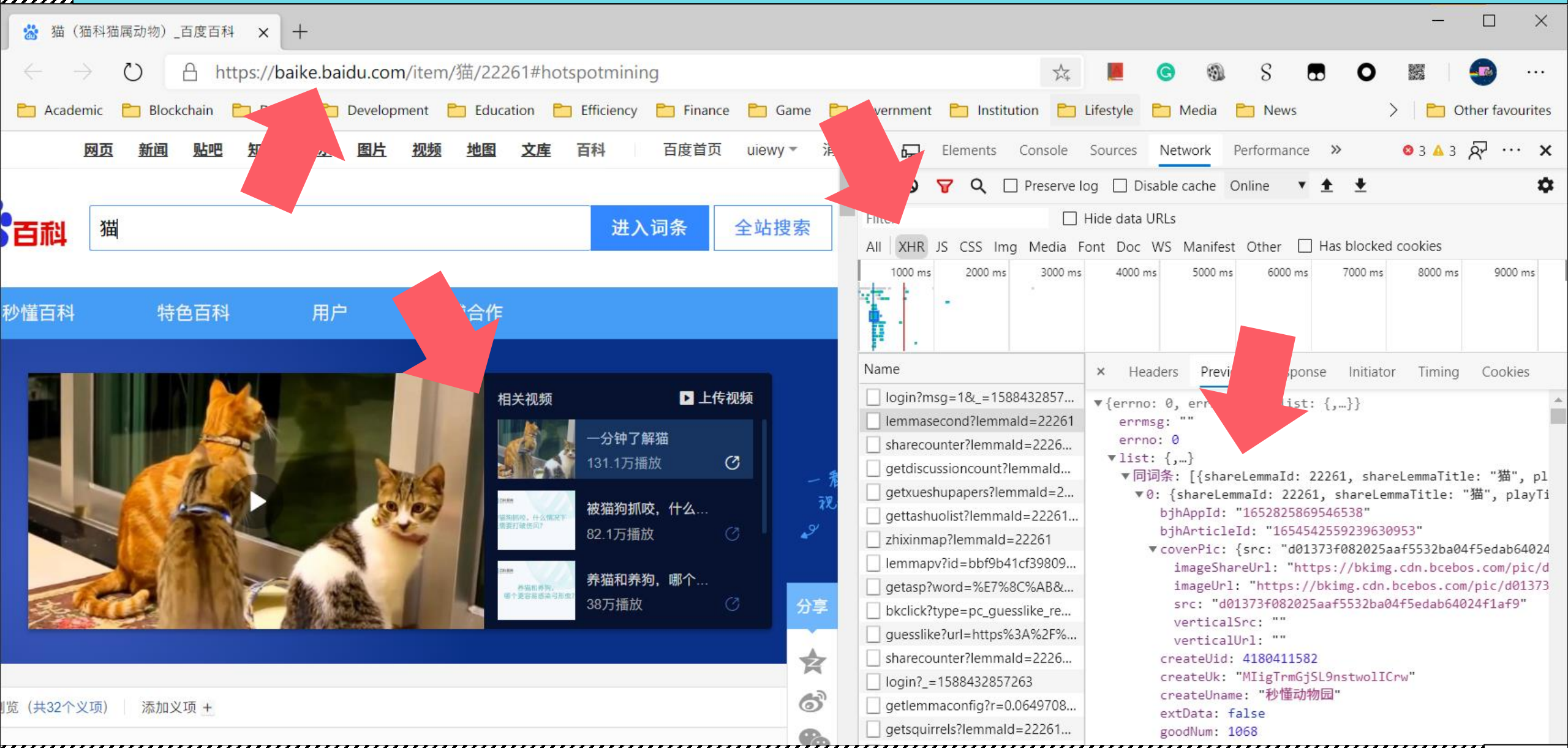
前端技术概述

REST UI

- 互联网应用前端（User Interface，UI）
- 又称“客户端”
- 与用户交互，并将用户操作转换为 API 请求
- 通过 API 与服务器通信，并取得用户希望获取的数据
- 通过丰富的客户端引擎将冰冷的数据展示为互联网应用
- UI 和 API 的统一接口通常为 JSON 或 XML

前端技术概述

REST UI



- 客户端引擎
- 不同的操作系统提供了不同的可视化客户端（GUI）引擎
- 移动互联网时代之前，跨平台需求并未得到重视
- 移动互联网时代之后，平台多样性明显改变：
- PC 网页端、移动网页端
- Windows / Mac / Linux 桌面应用程序
- Android / iOS 移动端应用程序

- 为每个不同平台开发应用程序的需求和成本急速上升

REST UI

- 可视化模块：将 API 传递的数据可视化并展示给最终用户，提供交互能力
- 用户介面（UI，User Interface）
- 三大最主流互联网 UI 框架：

- Electron
- https://www.electronjs.org/
- GitHub 开发的一个开源框架
- 使用 Node.js（作为后端）和 Chromium（作为前端）完成桌面 GUI 应用程序的开发
- Electron 现已被多个开源 Web 应用程序用于前端与后端的开发
- 著名项目包括 GitHub 的 Atom 和微软的 Visual Studio Code
- 针对：Windows / Mac / Linux 桌面应用程序

REST UI

Build cross-platform desktop apps with JavaScript, HTML, and CSS

REST UI

APACHE CORDOVA™

- Apache Cordova
- https://cordova.apache.org/
- 隶属于 Adobe 旗下的的一个移动端开源框架
- 由 Apache 基金会和 Adobe 共同管理
- 允许用户跨平台使用同一套代码部署移动端应用程序
- 支持的平台：iOS、Android
- 曾经支持的平台：Windows Phone、BlackBerry、Symbian 等
- 针对：Android / iOS 移动端应用程序

REST UI

APACHE

CORDOVA™

Mobile apps with HTML, CSS & JS

Target multiple platforms with one code base

Free and open source

GET STARTED DOCUMENTATION

node
JS
®

Express 4.17.1

Fast, unopinionated, minimalist web framework for Node.js

前端技术概述

从 UI 到全栈技术

web前端开发 [深圳湾] 09:01发布

10k-20k 经验应届毕业生 / 本科

前端开发

XMind

移动互联网 / 不需要融资 / 50-150人

"行业标杆、965、remote办公"

web前端开发工程师 [罗湖区] 2天前发布

12k-15k 经验应届毕业生 / 本科

前端开发 HTML5

阿卡索外教网

教育,移动互联网 / C轮 / 2000人以上

"五险一金，双休，错峰上班"

前端开发工程师 [坂田] 1天前发布

15k-30k 经验应届毕业生 / 本科

HTML5 Javascript Node.js Web前端

通力互联

软件开发 / 不需要融资 / 2000人以上

"大项目，薪资福利丰厚"

前端技术概述

从 UI 到全栈技术

高级 Node.js 全栈工程师 [南山区] 23:31发布

25k-35k 经验5-10年 / 本科

电商 企业服务 后端 全栈 Javascript Node.js

AfterShip

电商 / 不需要融资 / 50-150人

“全球项目、高薪资、高福利、国际团队”

全栈工程师 [南山区] 23:48发布

15k-30k 经验3-5年 / 本科

GO 后端 Shell 前端开发

即构科技

移动互联网,企业服务 / B轮 / 150-500人

“牛人团队,产品牛,市场大”

高级SRE工程师 [南山区] 23:31发布

25k-45k 经验5-10年 / 本科

运维 MongoDB DevOps 自动化运维

AfterShip

电商 / 不需要融资 / 50-150人

“全球项目、高薪资、高福利、国际团队”

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Vue.js 简介

- Vue.js
- https://vuejs.org/
- 简称 Vue，是一个基于 JavaScript / TypeScript 的开源 UI 框架
- 也是一个创建单页应用的互联网应用程序框架
- 在 GitHub 上目前排名前 10，最高曾超过 React 排名第 3

Github Ranking

Top 100 Stars

Ranking	Project Name	Stars	Forks	Language	Open Issues	Description	Last Commit
1	freeCodeCamp	364269	31646	TypeScript	141	freeCodeCamp.org's open-source codebase and curriculum. Learn to code for free.	2023-04-10T23:46:23Z
2	free-programming-books	275490	54685	None	26	Freely available programming books	2023-04-09T21:57:47Z
3	996.ICU	265522	21428	None	0	Repo for counting stars and contributing. Press F to pay respect to glorious developers.	2022-12-26T03:57:50Z
4	coding-interview-university	254163	67018	None	44	A complete computer science study plan to become a software engineer.	2023-04-03T15:47:07Z
5	awesome	248618	25386	None	25	Awesome lists about all kinds of interesting topics	2023-04-10T08:13:23Z
6	developer-roadmap	236429	33607	Astro	228	Interactive roadmaps, guides and other educational content to help developers grow in their careers.	2023-04-10T22:28:10Z
7	public-apis	235504	26747	Python	42	A collective list of free APIs	2023-04-10T12:03:18Z
8	system-design-primer	217278	38624	Python	175	Learn how to design large-scale systems. Prep for the system design interview. Includes Anki flashcards.	2023-04-10T01:01:51Z
9	react	205592	42824	JavaScript	959	The library for web and native user interfaces	2023-04-11T02:45:44Z
10	vue	203121	33568	TypeScript	365	This is the repo for Vue 2. For Vue 3, go to https://github.com/vuejs/core	2023-04-06T14:05:35Z

安装 Vue.js

- Node.js
- https://nodejs.org/

- 一个能够在服务器端运行 JavaScript 的开源、跨平台运行环境
- 由 OpenJS Foundation 维护，亦为 Linux 基金会的项目
- 采用 Google 开发的 V8 运行代码，使用事件驱动、非阻塞和异步输入输出模型等技术来提高性能，可优化应用程序的传输量和规模
- 在 Node.js 出现之前，JavaScript 通常作为客户端程序设计语言使用，以 JavaScript 编写的程序通常在用户的浏览器上运行
- Node.js 的出现使得 JavaScript 也能用于服务端编程
- 目前几乎所有的互联网公司都使用了 Node.js 及其相关技术

安装 Vue.js

- 安装 Node.js
- https://nodejs.org/en/download/

Downloads

Latest LTS Version: **18.15.0** (includes npm 9.5.0)

Download the Node.js source code or a pre-built installer for your platform, and start developing today.

LTS Recommended For Most Users	Current Latest Features

Windows Installer

node-v18.15.0-x64.msi

macOS Installer

node-v18.15.0.pkg

Source Code

node-v18.15.0.tar.gz

安装 Vue.js

- 使用 APT 在 Ubuntu 22.04 上安装 Node.js
- https://github.com/nodesource/distributions

- `curl -fsSL https://deb.nodesource.com/setup_18.x | sudo -E bash -`
- `sudo apt install nodejs`

```
~ » node -v
v16.15.0
~ » npm -v
8.5.5
```

安装 Vue.js

- NPM
- https://www.npmjs.com/

- Node.js 的一个软件包管理器
- 2020 年 4 月被 GitHub 收购
- 截止到 2016 年 7 月，NPM 的 Registry 上已经注册了超过 280,000 个模块

- NPM 是 Node.js 的默认软件包管理器，安装 Node.js 通常会一并安装 NPM

安装 Vue.js

- 阿里云 NPM 镜像
- http://www.npmmirror.com/

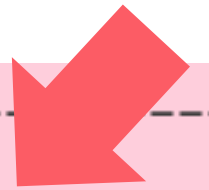
- 配置阿里云 NPM 镜像：
- `npm install -g cnpm --registry=https://registry.npmmirror.com`

- 配置完毕之后可以使用 cnpm 替换 npm，例如：
- `cnpm i -g @vue/cli`

安装 Vue.js

- Vue CLI
- https://cli.vuejs.org/
- Vue.js 的 CLI（命令行用户界面，Command Line Interface）

- 安装 Vue CLI
- `npm i -g @vue/cli`



```
~ » vue -V
@vue/cli 4.5.11
```

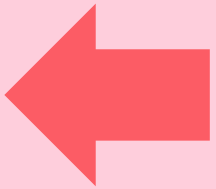
使用 Vue.js

- 使用 Vue CLI 创建一个新的 Vue 项目
- vue create hello-world

```
~/Workspace/course » vue create hello-world
?  Your connection to the default npm registry seems to be slow.
   Use https://registry.npm.taobao.org for faster installation? Yes


Vue CLI v4.3.1
? Please pick a preset: default (babel, eslint)


Vue CLI v4.3.1
✨  Creating project in /mnt/e/Workspace/course/hello-world.
🗃  Initializing git repository...
⚙  Installing CLI plugins. This might take a while...
```

使用 Vue.js

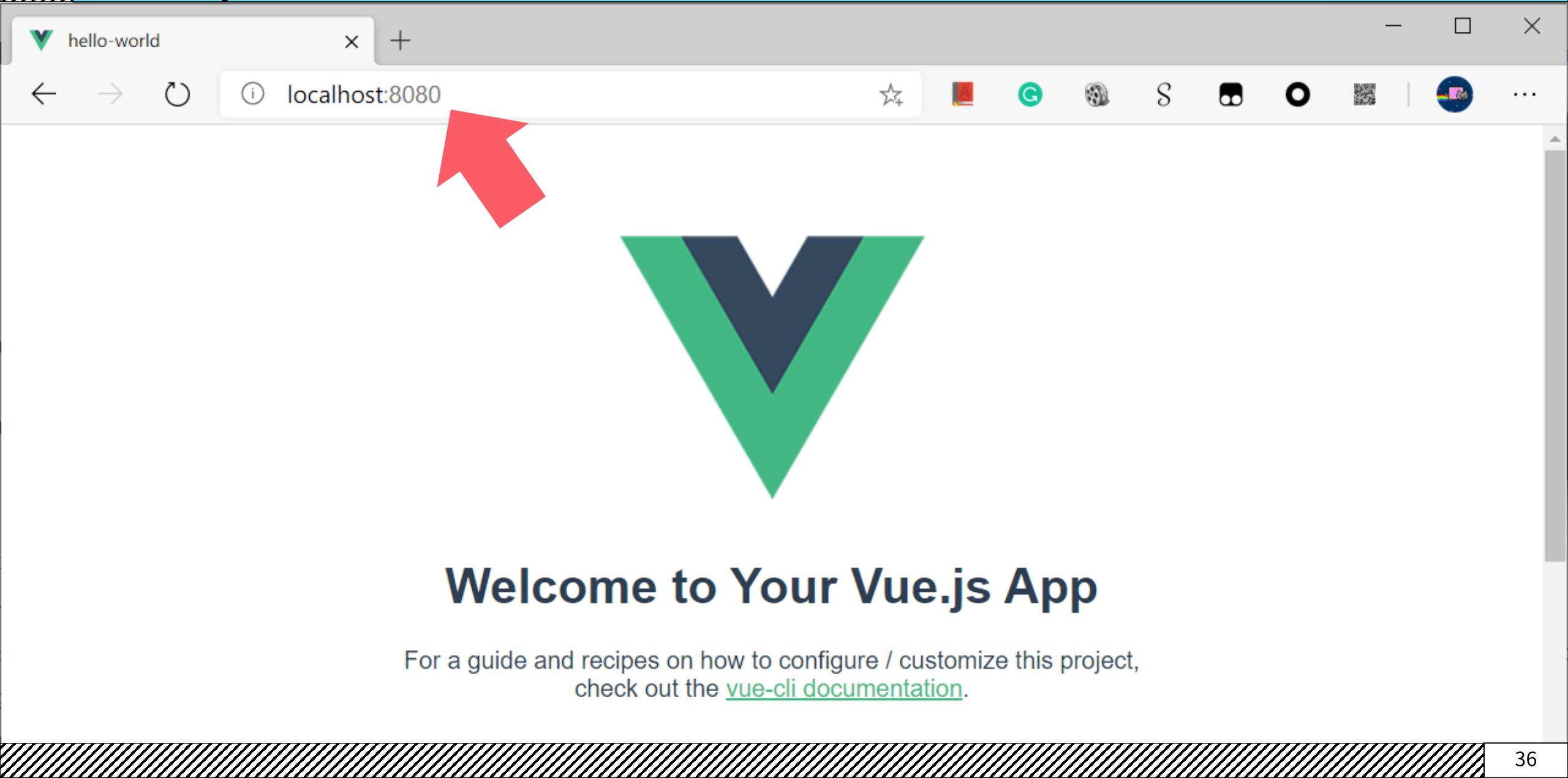
```
43 packages are looking for funding
  run `npm fund` for details

🚀  Invoking generators...
📦  Installing additional dependencies...

added 53 packages from 36 contributors in 9.664s

46 packages are looking for funding
  run `npm fund` for details

⚓  Running completion hooks...

📄  Generating README.md...

🎉  Successfully created project hello-world.
👉  Get started with the following commands:

 $ cd hello-world
 $ npm run serve
```

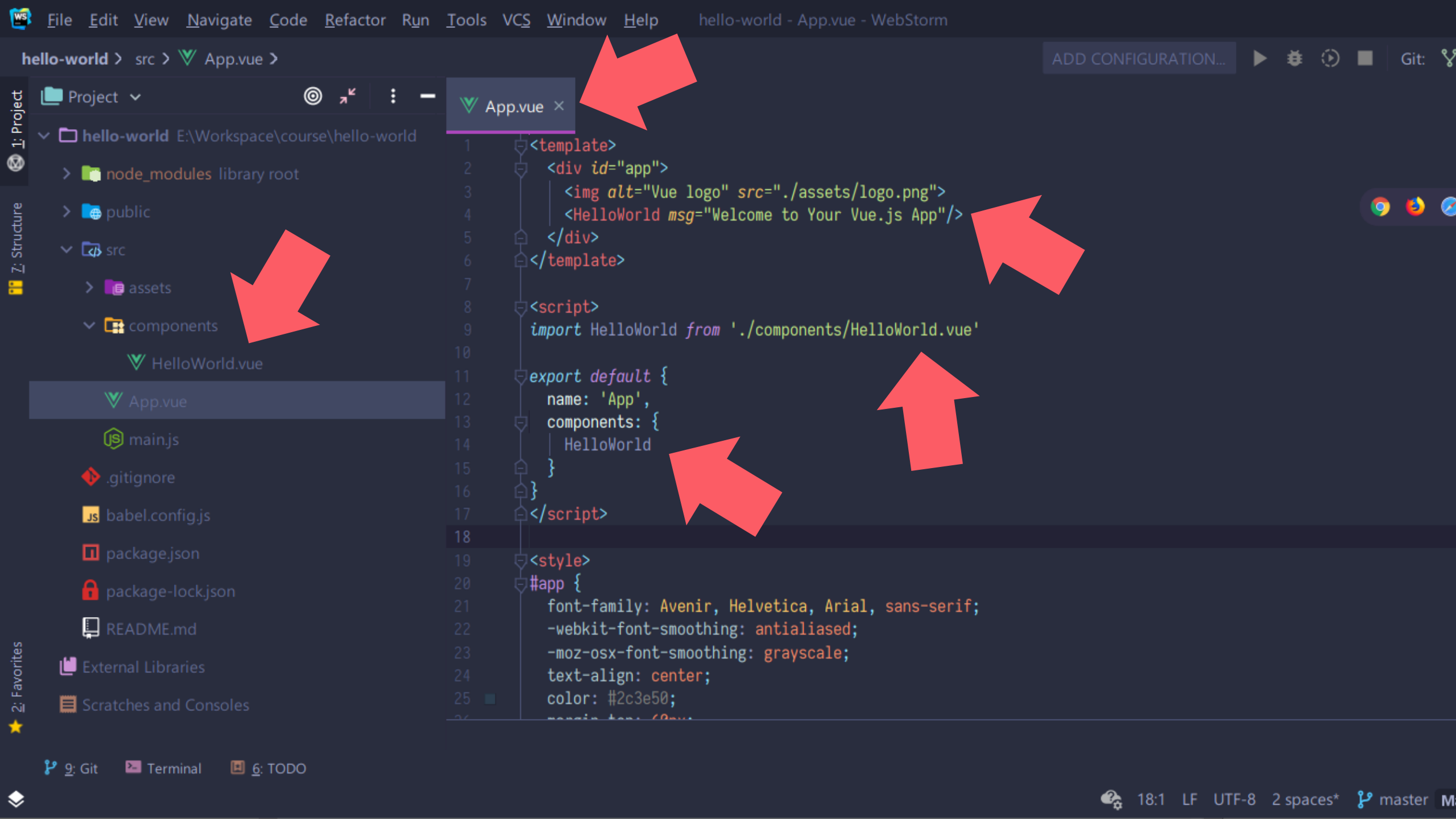


- 启动 Vue 服务
- cd hello-world && npm run serve

```
 DONE  Compiled successfully in 11837ms


  App running at:
  - Local:   http://localhost:8080/
  - Network: http://172.20.254.114:8080/

  Note that the development build is not optimized.
  To create a production build, run npm run build.
```

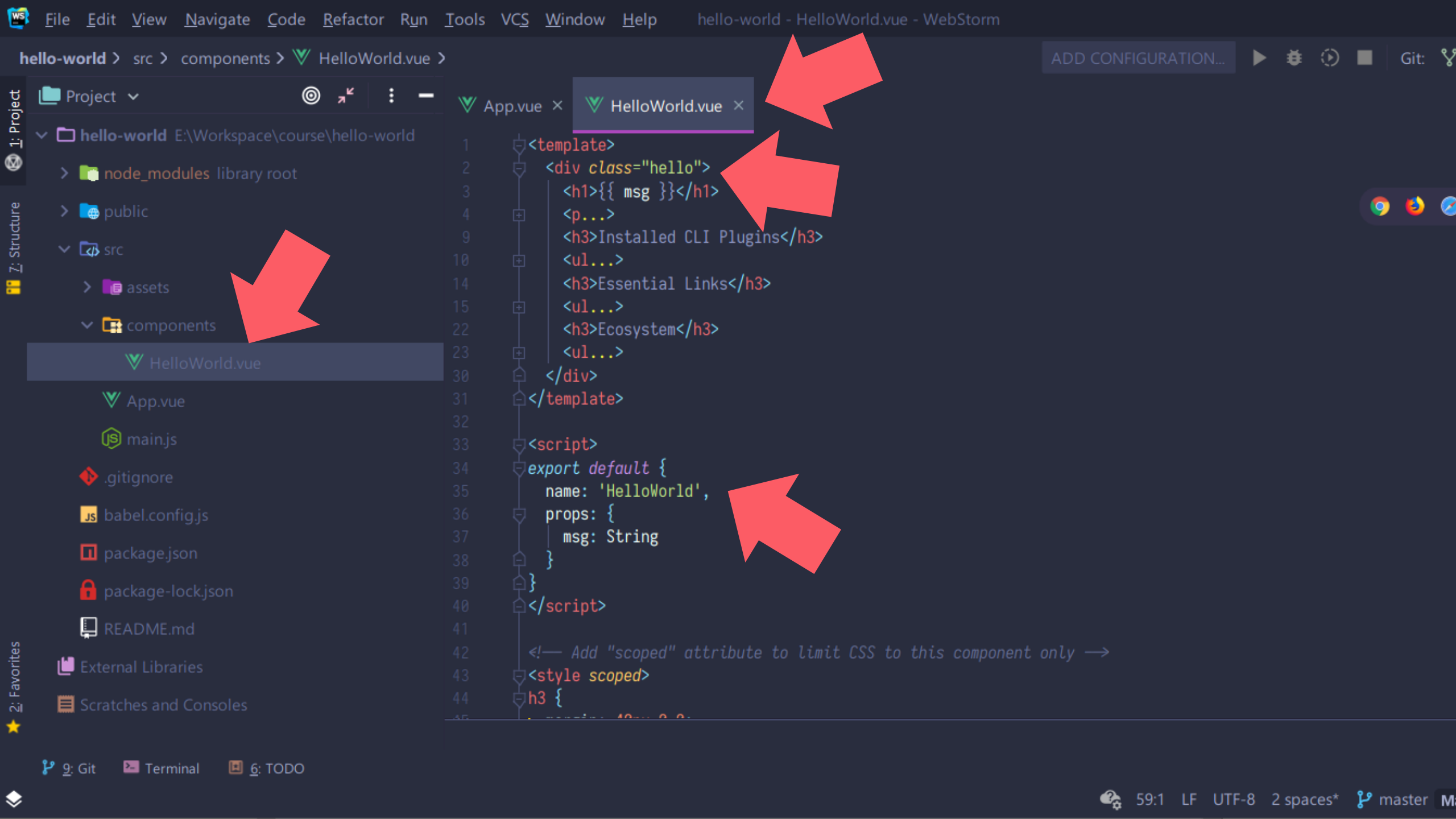
使用 Vue.js


hello-world
localhost:8080
Welcome to Your Vue.js App
For a guide and recipes on how to configure / customize this project,
check out the vue-cli documentation.


File Edit View Navigate Code Refactor Run Tools VCS Window Help
hello-world - App.vue - WebStorm
hello-world > src > App.vue >
ADD CONFIGURATION...
Git:
Project
App.vue
hello-world E:\Workspace\course\hello-world
node_modules library root
public
src
assets
components
HelloWorld.vue
App.vue
main.js
.gitignore
babel.config.js
package.json
package-lock.json
README.md
External Libraries
Scratches and Consoles
<template>

<img alt="Vue logo" src="./assets/logo.png">
<HelloWorld msg="Welcome to Your Vue.js App"/>

</template>
<script>
import HelloWorld from './components/HelloWorld.vue'
export default {
name: 'App',
components: {
HelloWorld
}
}
</script>
<style>
#app {
font-family: Avenir, Helvetica, Arial, sans-serif;
-webkit-font-smoothing: antialiased;
-moz-osx-font-smoothing: grayscale;
text-align: center;
color: #2c3e50;
1: Project
7: Structure
2: Favorites
9: Git
Terminal
6: TODO
18:1 LF UTF-8 2 spaces* master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package-lock.json
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<template>

<h1>{{ msg }}</h1>
<p...>
<h3>Installed CLI Plugins</h3>
<ul...>
<h3>Essential Links</h3>
<ul...>
<h3>Ecosystem</h3>
<ul...>

</template>
<script>
export default {
name: 'HelloWorld',
props: {
msg: String
}
}
</script>
<!-- Add "scoped" attribute to limit CSS to this component only -->
<style scoped>
h3 {
1: Project
7: Structure
2: Favorites
9: Git
Terminal
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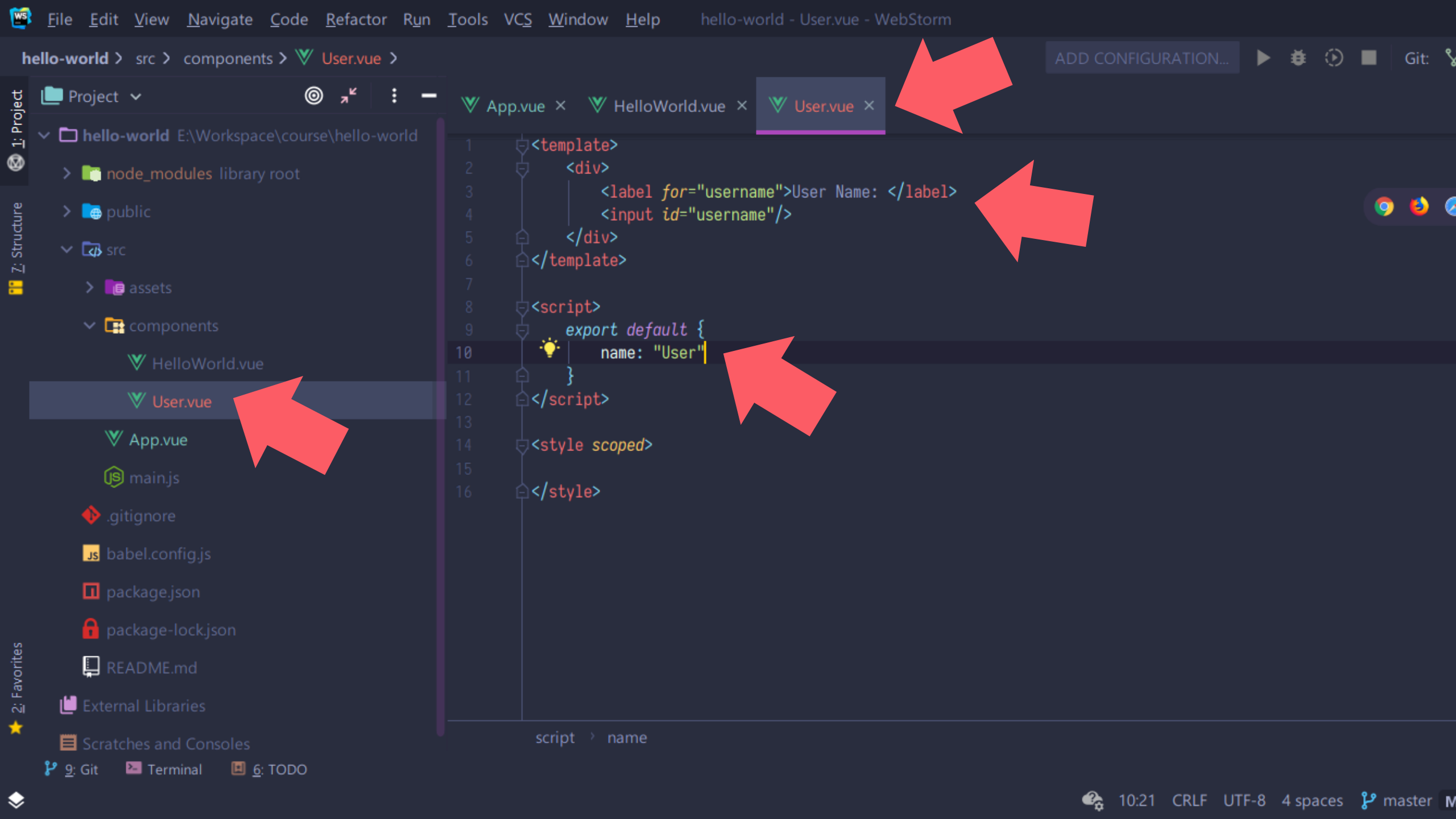
59:1 LF UTF-8 2 spaces* master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hello-world E:\Workspace\course\hello-world
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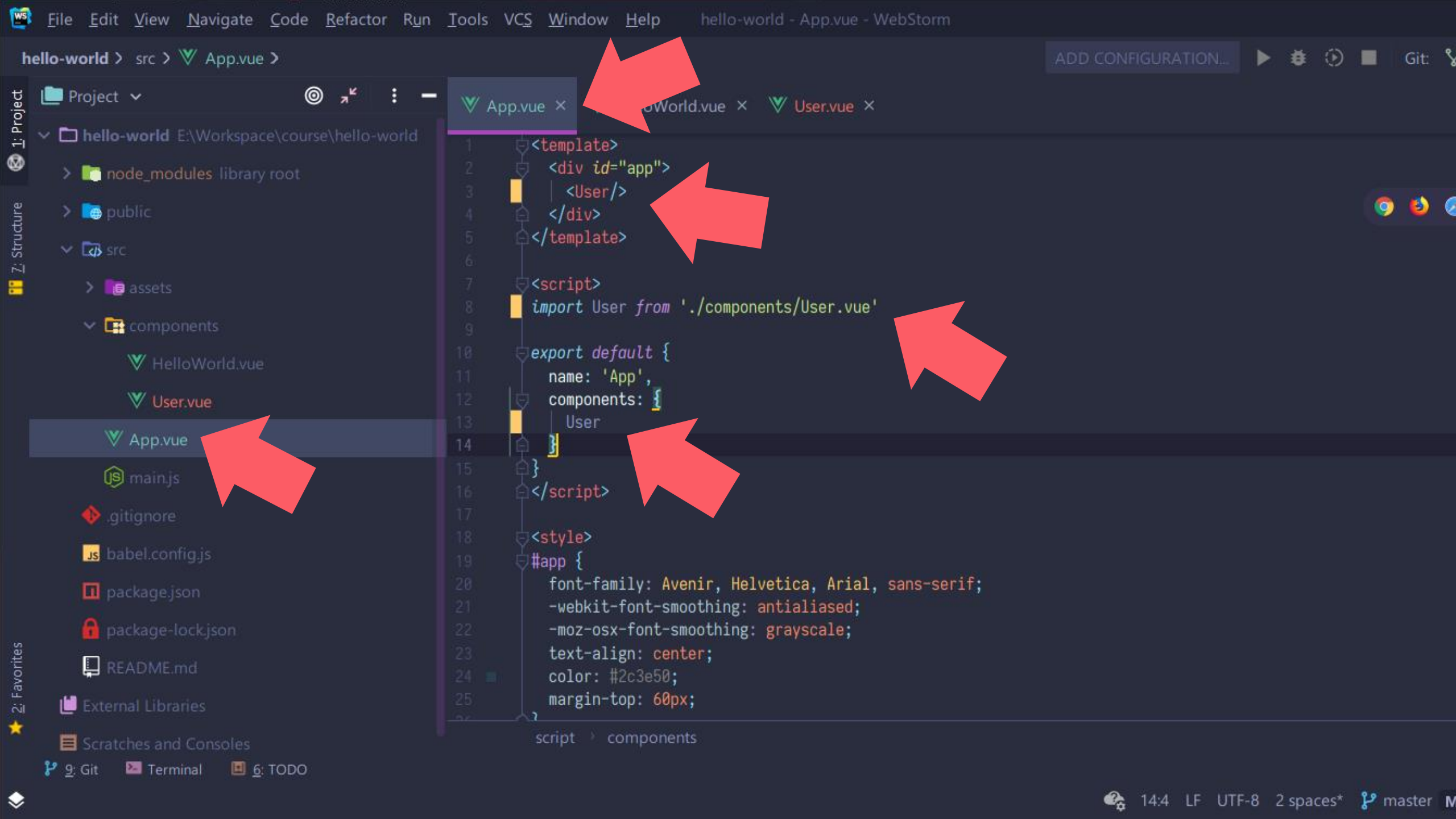
App.vue
HelloWorld.vue
User.vue
<template>

<label for="username">User Name: </label>
<input id="username"/>

</template>
<script>
export default {
name: "User"
}
</script>
<style scoped>
</style>
script > name
1: Project
7: Structure
2: Favorites
9: Git
Terminal
6: TODO
10:21 CRLF UTF-8 4 spaces master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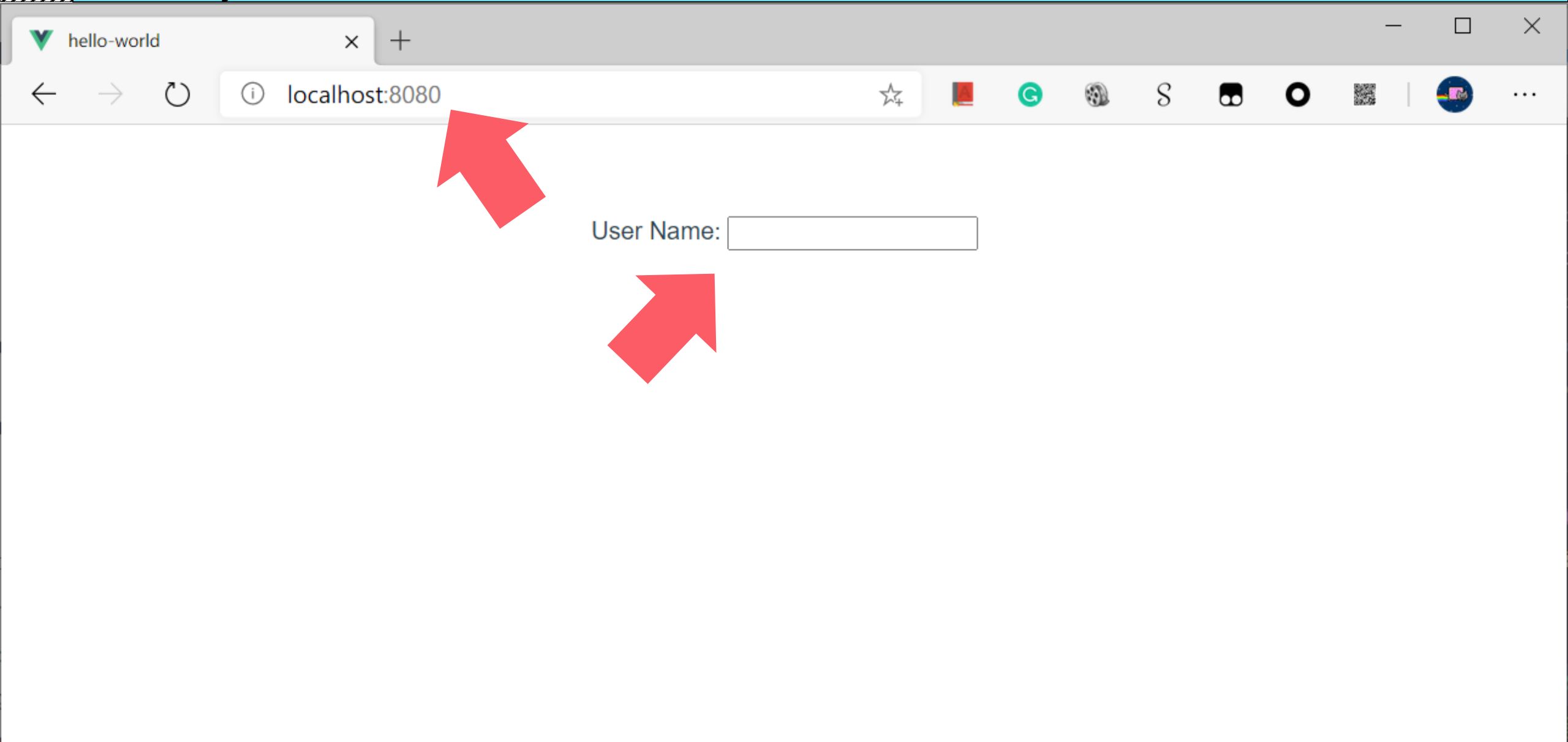
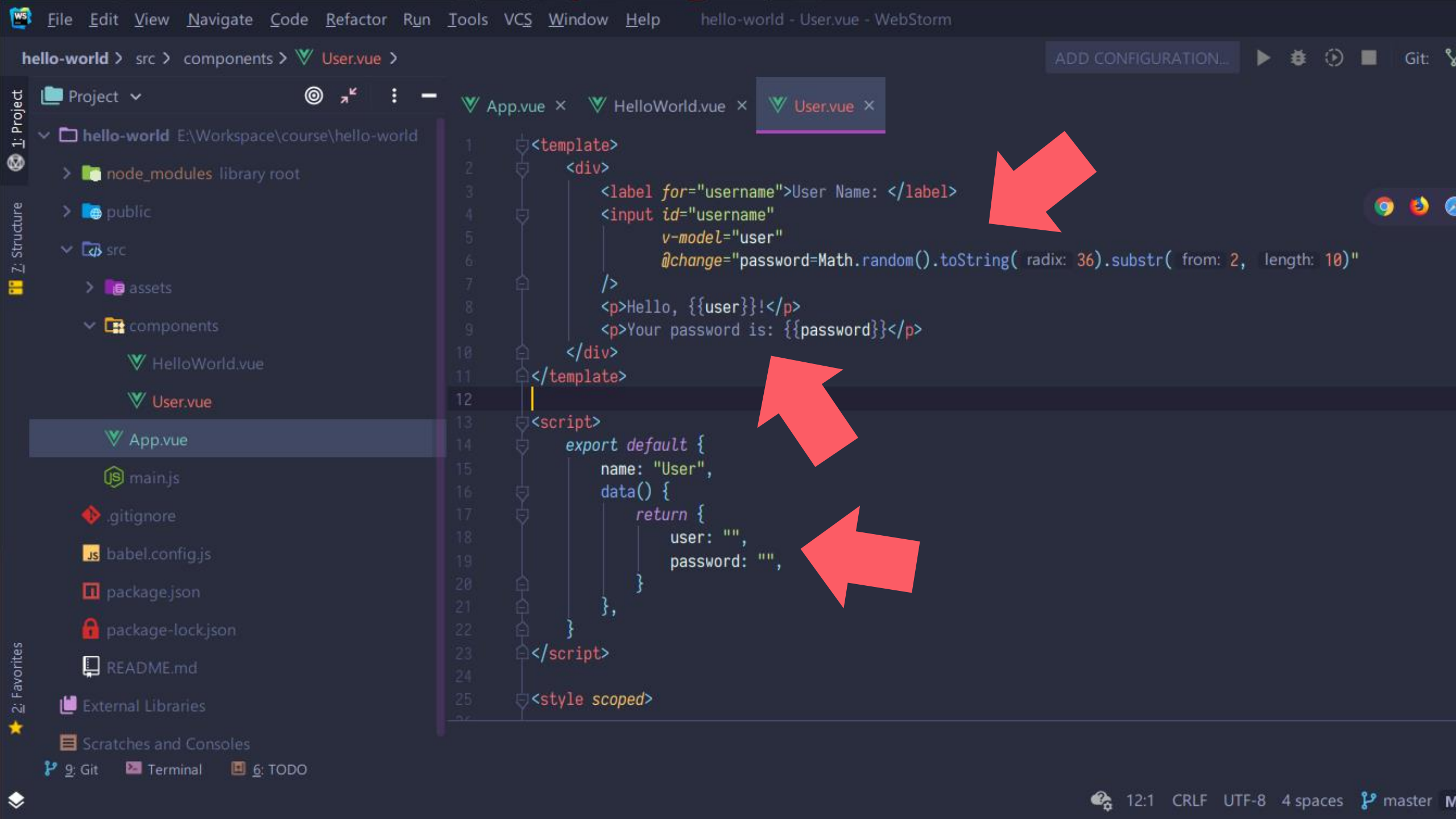
<User/>

</template>
<script>
import User from './components/User.vue'
export default {
name: 'App',
components: {
User
}
}
</script>
<style>
#app {
font-family: Avenir, Helvetica, Arial, sans-serif;
-webkit-font-smoothing: antialiased;
-moz-osx-font-smoothing: grayscale;
text-align: center;
color: #2c3e50;
margin-top: 60px;
script > components
9: Git
Terminal
6: TODO
14:4 LF UTF-8 2 spaces* master

使用 Vue.js

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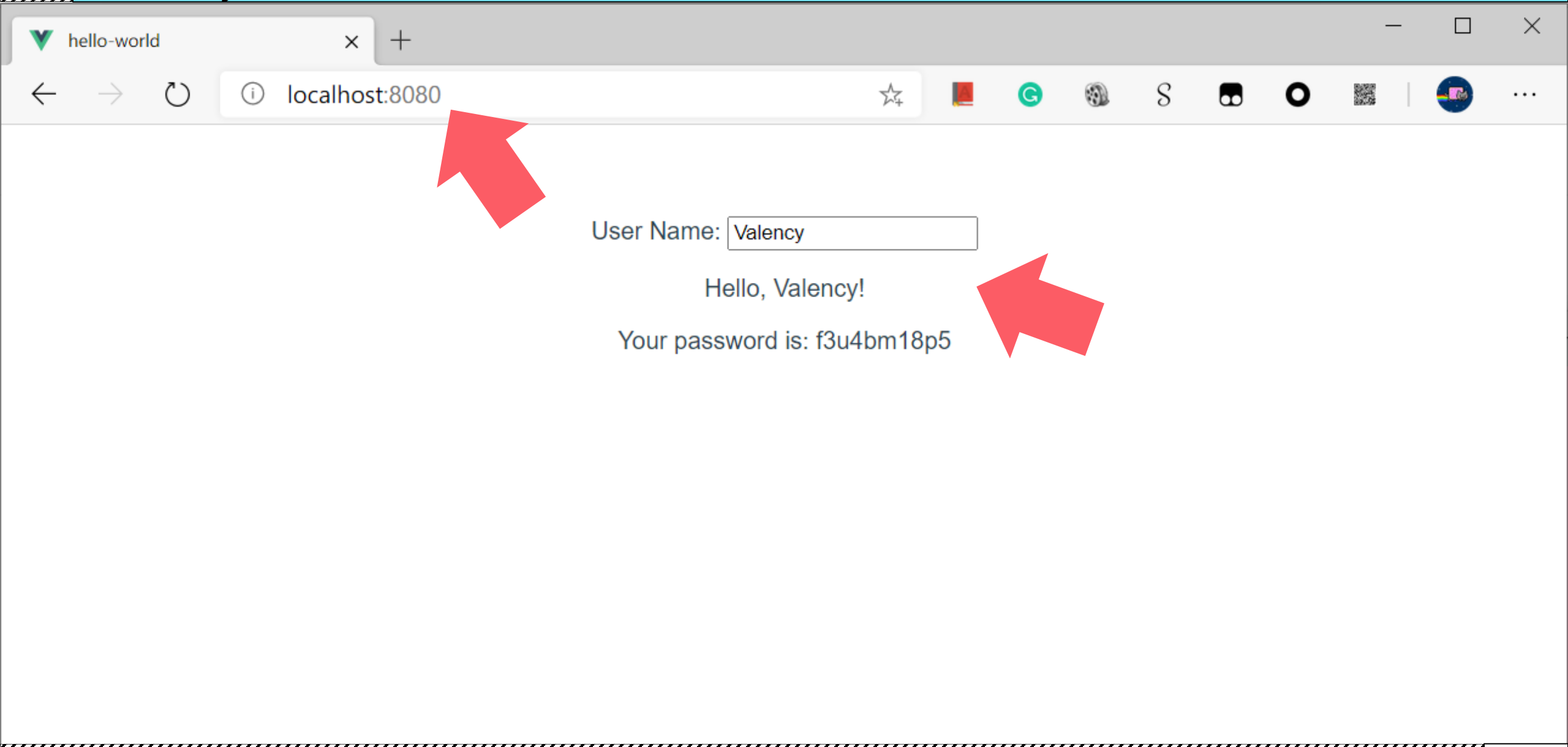
package-lock.json
README.md
External Libraries
Scratches and Consoles
<template>

<label for="username">User Name: </label>
<input id="username"
v-model="user"
@change="password=Math.random().toString(radix: 36).substr(from: 2, length: 10)"
/>
Hello, {{user}}!
Your password is: {{password}}

</template>
<script>
export default {
name: "User",
data() {
return {
user: "",
password: "",
}
},
}
</script>
<style scoped>
9: Git
Terminal
6: TODO
12:1
CRLF
UTF-8
4 spaces
master

使用 Vue.js


hello-world
localhost:8080
User Name: Valency
Hello, Valency!
Your password is: f3u4bm18p5

- Vue.js 官方教程：
- https://cn.vuejs.org/guide/introduction.html

- Vue CLI 官方教程：
- https://cli.vuejs.org/zh/guide/

尤雨溪

前端框架Vue.js 作者，独立开源开发者，现居美国新泽西，现在全职开发和维护 Vue.js。

本期嘉宾

尤雨溪 (Evan You)，前端框架Vue.js 作者，独立开源开发者，现居美国新泽西。曾就职于 Google Creative Labs 和 Meteor Development Group。由于工作中大量接触开源的 JavaScript 项目，最后自己也走上了开源之路，现在全职开发和维护 Vue.js。

Vue.js vs. React

- React
- https://reactjs.org/
- 又称 React.js，是基于 JavaScript 的开源 UI 框架
- React 由 Facebook、Instagram 和社群维护
- React 当前正在被 Netflix、Imgur、Bleacher Report、Feedly、Airbnb、SeatGeek、HelloSign 等很多企业使用
- 目前 GitHub 排名第 9，框架类（Framework）组件排名第 1

Github Ranking

Top 100 Stars

Ranking	Project Name	Stars	Forks	Language	Open Issues	Description	Last Commit
1	freeCodeCamp	364269	31646	TypeScript	141	freeCodeCamp.org's open-source codebase and curriculum. Learn to code for free.	2023-04-10T23:46:23Z
2	free-programming-books	275490	54685	None	26	Freely available programming books	2023-04-09T21:57:47Z
3	996.ICU	265522	21428	None	0	Repo for counting stars and contributing. Press F to pay respect to glorious developers.	2022-12-26T03:57:50Z
4	coding-interview-university	254163	67018	None	44	A complete computer science study plan to become a software engineer.	2023-04-03T15:47:07Z
5	awesome	248618	25386	None	25	Awesome lists about all kinds of interesting topics	2023-04-10T08:13:23Z
6	developer-roadmap	236429	33607	Astro	228	Interactive roadmaps, guides and other educational content to help developers grow in their careers.	2023-04-10T22:28:10Z
7	public-apis	235504	26747	Python	42	A collective list of free APIs	2023-04-10T[illegible]:18Z
8	system-design-primer	217278	38624	Python	175	Learn how to design large-scale systems. Prep for the system design interview. Includes Anki flashcards.	[illegible]:01:51Z
9	react	205592	42824	JavaScript	959	The library for web and native user interfaces	2023-04-11T02:45:44Z
10	vue	203121	33568	TypeScript	365	This is the repo for Vue 2. For Vue 3, go to https://github.com/vuejs/core	2023-04-06T14:05:35Z

An Application

Using `props` and `state`, we can put together a small Todo application. This example uses `state` to track the current list of items as well as the text that the user has entered. Although event handlers appear to be rendered inline, they will be collected and implemented using event delegation.

LIVE JSX EDITOR ☑ JSX?

```
class TodoApp extends React.Component {
  constructor(props) {
    super(props);
    this.state = { items: [], text: '' };
    this.handleChange = this.handleChange.bind(this);
    this.handleSubmit = this.handleSubmit.bind(this);
  }

  render() {
    return (
      <div>
        <h3>TODO</h3>
        <TodoList items={this.state.items} />
        <form onSubmit={this.handleSubmit}>
          <label htmlFor="new-todo">
            What needs to be done?
```

RESULT

TODO

What needs to be done?

Add #1

目录

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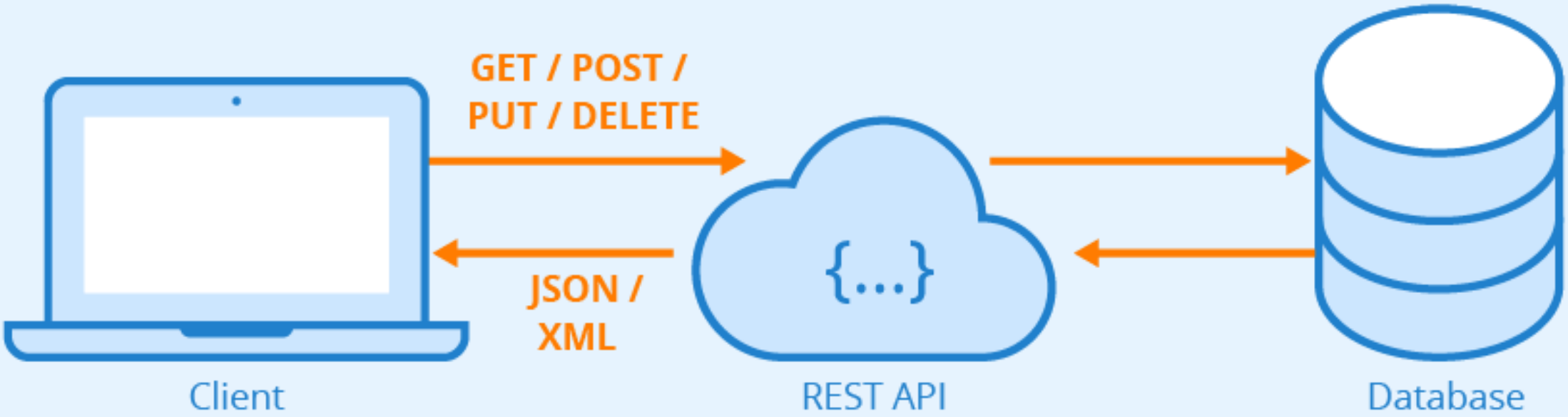
2 Vue.js

3 连接 UI 和 API

4 常见的 UI 组件库

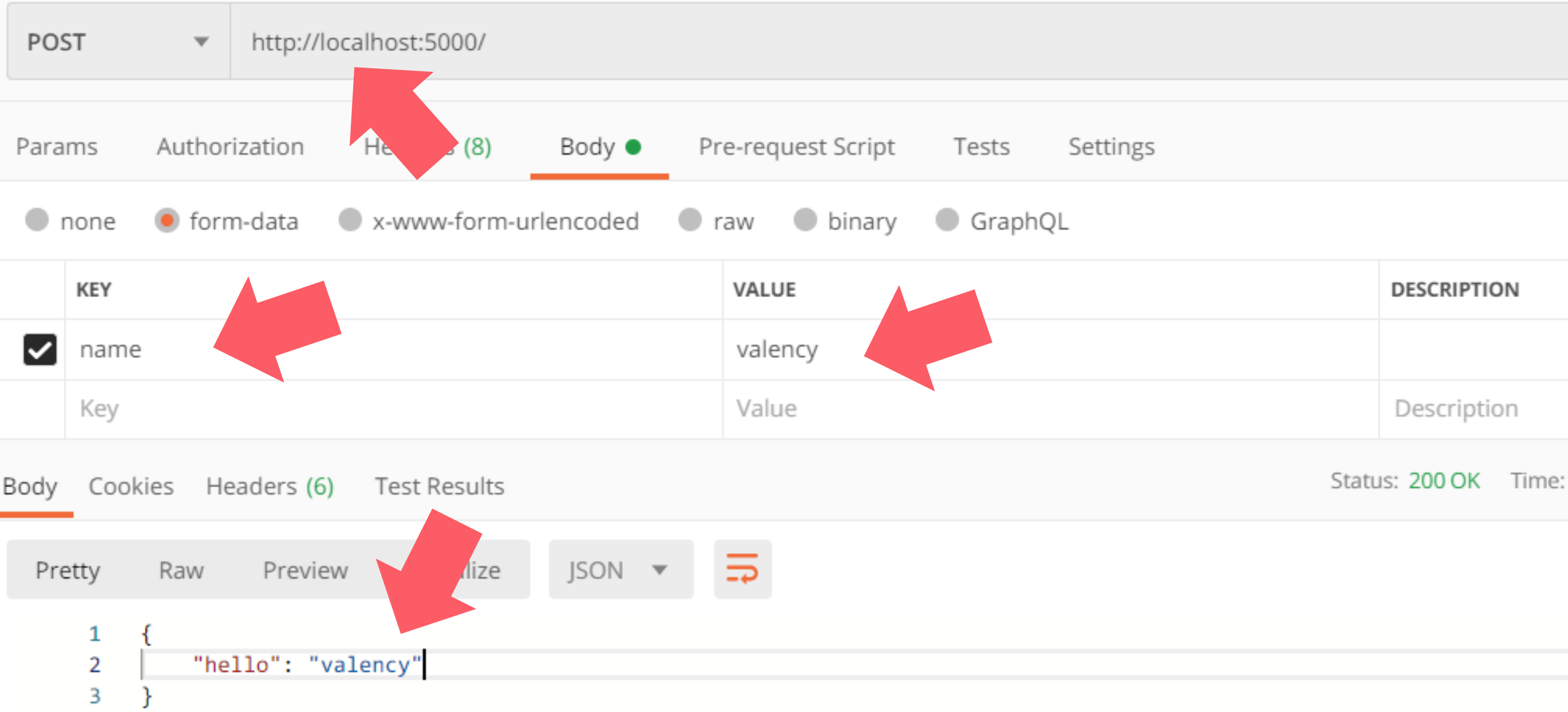
连接 UI 和 API

REST API



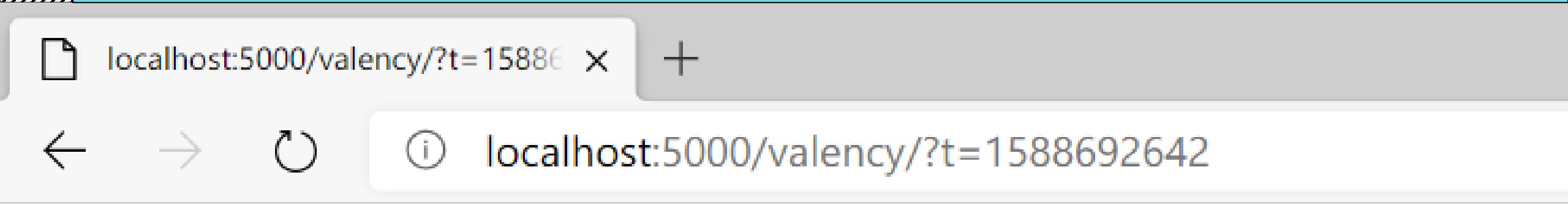
连接 UI 和 API

REST API



连接 UI 和 API

REST API



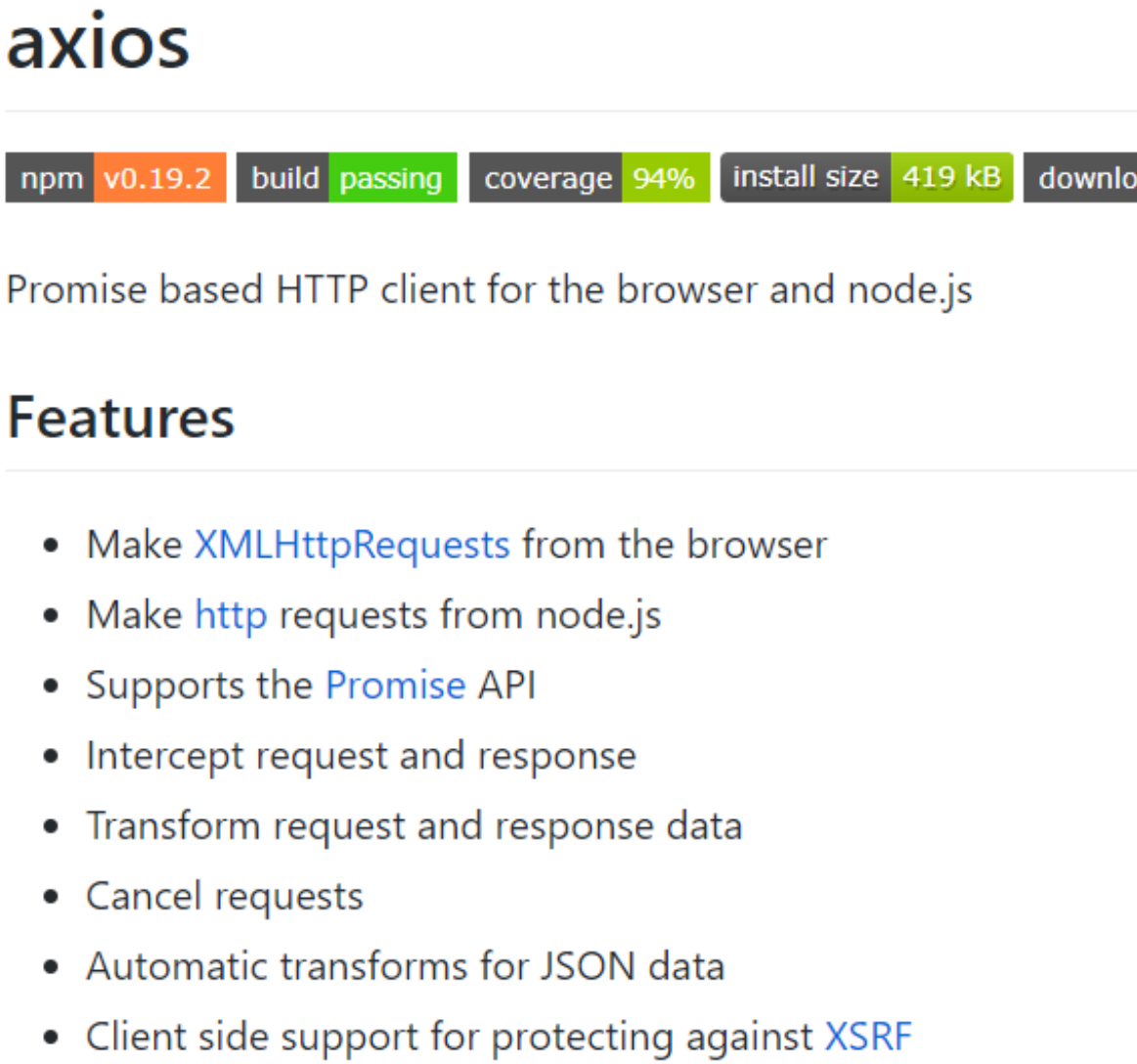

```
[
    {
        "id": 3,
        "name": "valency"
    },
    {
        "id": 4,
        "name": "valency"
    }
]
```

连接 UI 和 API

安装 Axios

- Axios
- https://github.com/axios/axios
- 一个基于 JavaScript 的 REST API 客户端

- 安装 Axios：
- `npm i --save axios`



File Edit View Navigate Code Refactor Run Tools VCS Window Help hello-world - User.vue - WebStorm

hello-world > src > components > User.vue >

ADD CONFIGURATION... Git:

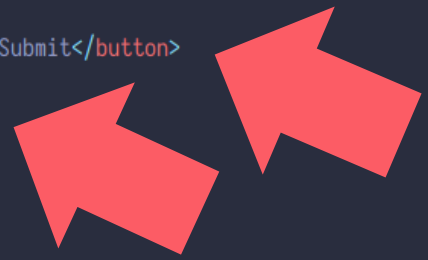
Project

hello-world E:\Workspace\course\hello-world

- node_modules library root
- public
- src
  - assets
  - components
    - HelloWorld.vue
    - User.vue
  - App.vue
  - main.js
- .gitignore
- babel.config.js
- package.json
- package-lock.json
- README.md
- vue.config.js
- External Libraries
- Scratches and Consoles

App.vue × HelloWorld.vue × User.vue × vue.config.js ×

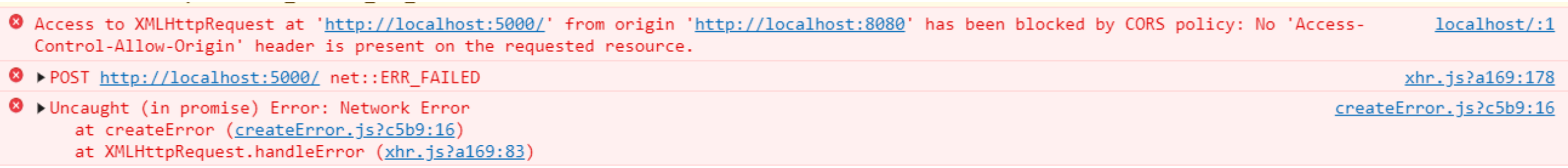
```vue
<template>
    <div>
        <label for="username">User Name: </label>
        <input id="username"
               v-model="user"
               @change="password=Math.random().toString( radix: 36).substr( from: 2,  length: 10)"
        />
        <p>Hello, {{user}}!</p>
        <p>Your password is: {{password}}</p>
        <p>
            <button @click="register()">Submit</button>
        </p>
        <p>Your user id is: {{uid}}</p>
    </div>
</template>

<script>
    const axios = require('axios').default
    export default {
        name: "User",
        data() {
            return {
                user: "",
                password: "",
                uid: "",
            }
        },
        methods: {
            register() {
                let form = new FormData()
                form.set( name: 'name', this.user)
                axios.post('/api/', form).then((res) => {
                    this.uid = res.data.id
                })
            },
        }
    }
</script>
```



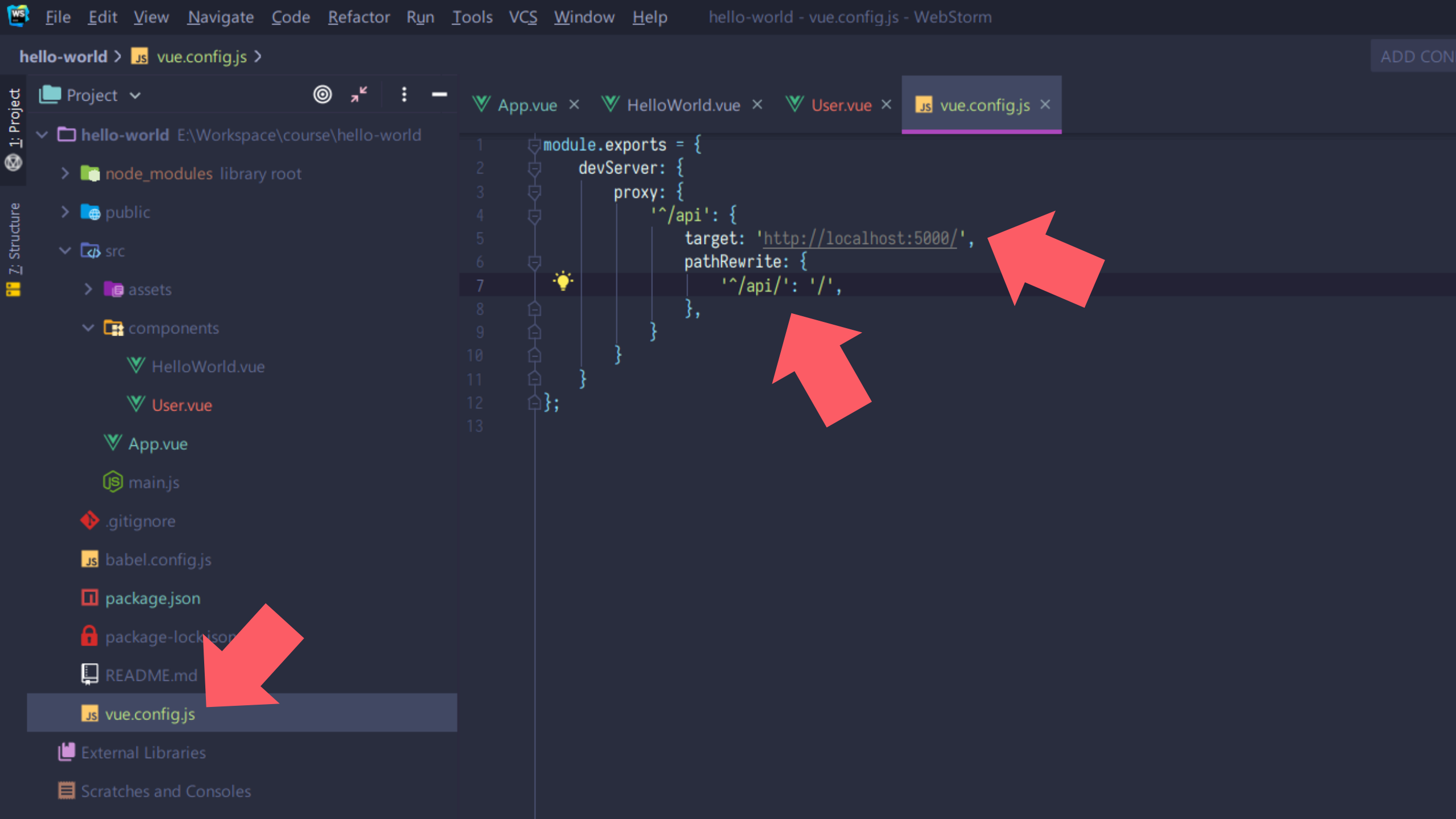
连接 UI 和 API

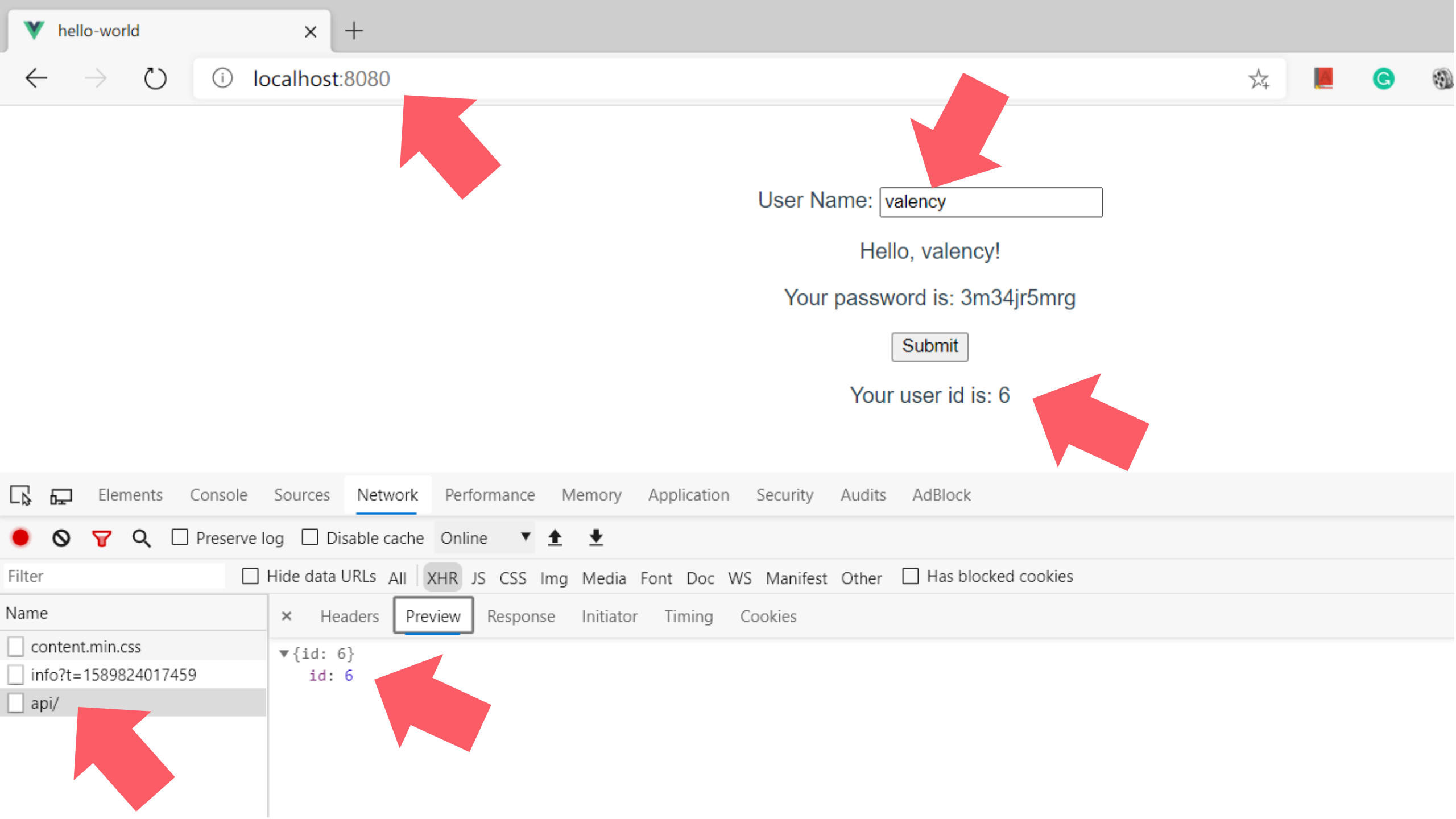
使用 Axios

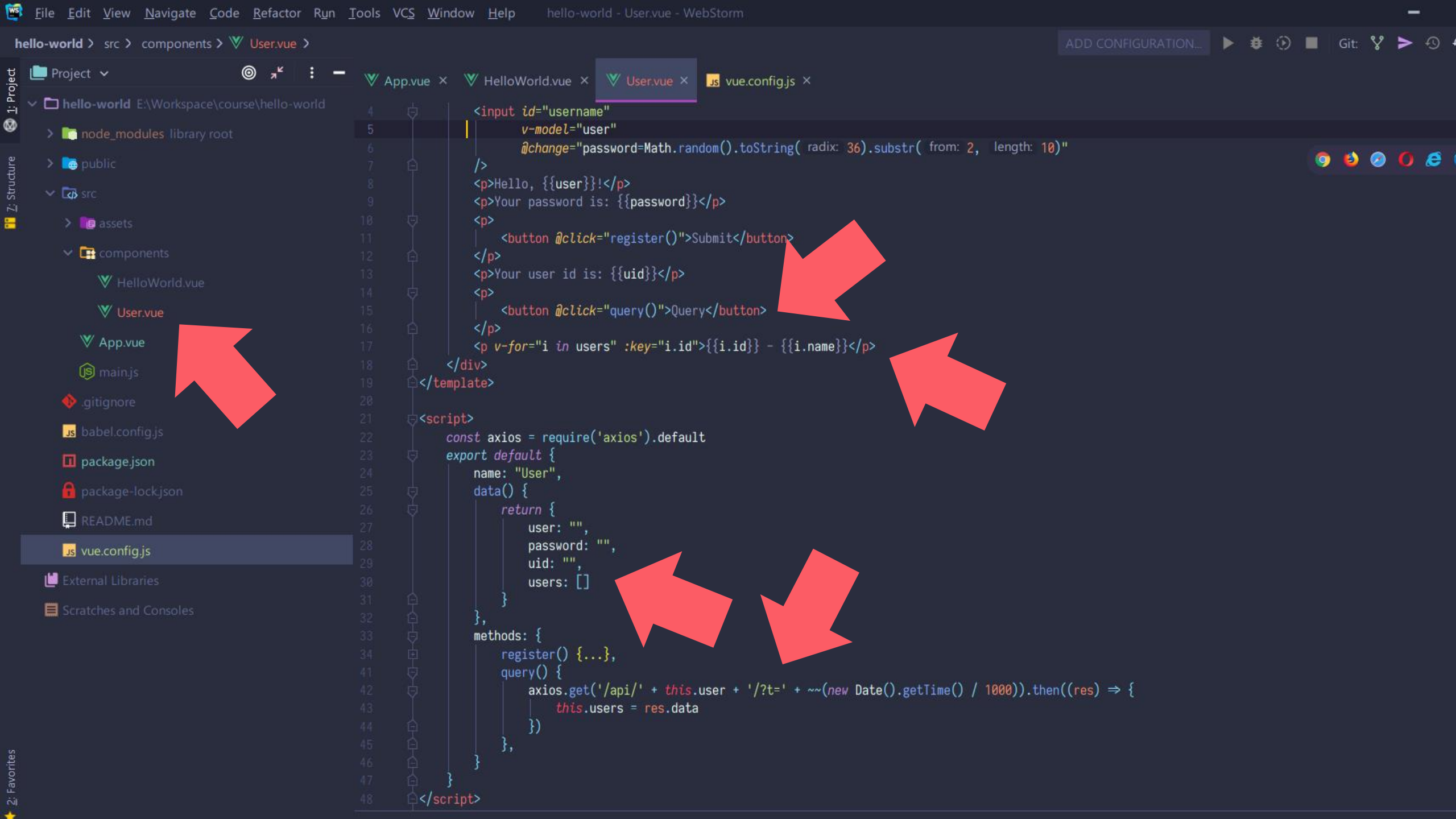
- 跨域资源共享（Cross-Origin Resource Sharing，CORS）
- 用于让网页的受限资源能够被其他域名的页面访问的一种机制
- 通过 CORS 机制，页面能够自由地使用不同源（Cross-origin）的资源
- 一些跨域的请求（特别是 Ajax）常常会被同源策略（Same-origin Policy）禁止
- 简单来讲，就是在没有开启 CORS 的情况下，不能用 8080 端口的互联网应用程序去访问 5000 端口的互联网应用程序



- CORS 并不安全，一般不建议开启，而应当使用代理（Proxy）的方式访问资源


File Edit View Navigate Code Refactor Run Tools VCS Window Help
hello-world - vue.config.js - WebStorm
hello-world > vue.config.js >
ADD CON
1: Project
7: Structure
Project
hello-world E:\Workspace\course\hello-world
node_modules library root
public
src
assets
components
HelloWorld.vue
User.vue
App.vue
main.js
.gitignore
babel.config.js
package.json
package-lock.json
README.md
vue.config.js
External Libraries
Scratches and Consoles
App.vue
HelloWorld.vue
User.vue
vue.config.js
module.exports = {
devServer: {
proxy: {
'^/api': {
target: 'http://localhost:5000/',
pathRewrite: {
'^/api/': '/',
},
}
}
}
};


hello-world
localhost:8080
User Name: valency
Hello, valency!
Your password is: 3m34jr5mrg
Submit
Your user id is: 6
Elements
Console
Sources
Network
Performance
Memory
Application
Security
Audits
AdBlock
Preserve log
Disable cache
Online
Filter
Hide data URLs
All
XHR
JS
CSS
Img
Media
Font
Doc
WS
Manifest
Other
Has blocked cookies
Name
content.min.css
info?t=1589824017459
api/
Headers
Preview
Response
Initiator
Timing
Cookies
{id: 6}
id: 6


File Edit View Navigate Code Refactor Run Tools VCS Window Help
hello-world - User.vue - WebStorm
hello-world > src > components > User.vue
ADD CONFIGURATION...
Git:
Project
hello-world E:\Workspace\course\hello-world
node_modules library root
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main.js
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vue.config.js
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App.vue
HelloWorld.vue
User.vue
vue.config.js
<input id="username"
v-model="user"
@change="password=Math.random().toString(radix: 36).substr(from: 2, length: 10)"
/>
Hello, {{user}}!
Your password is: {{password}}

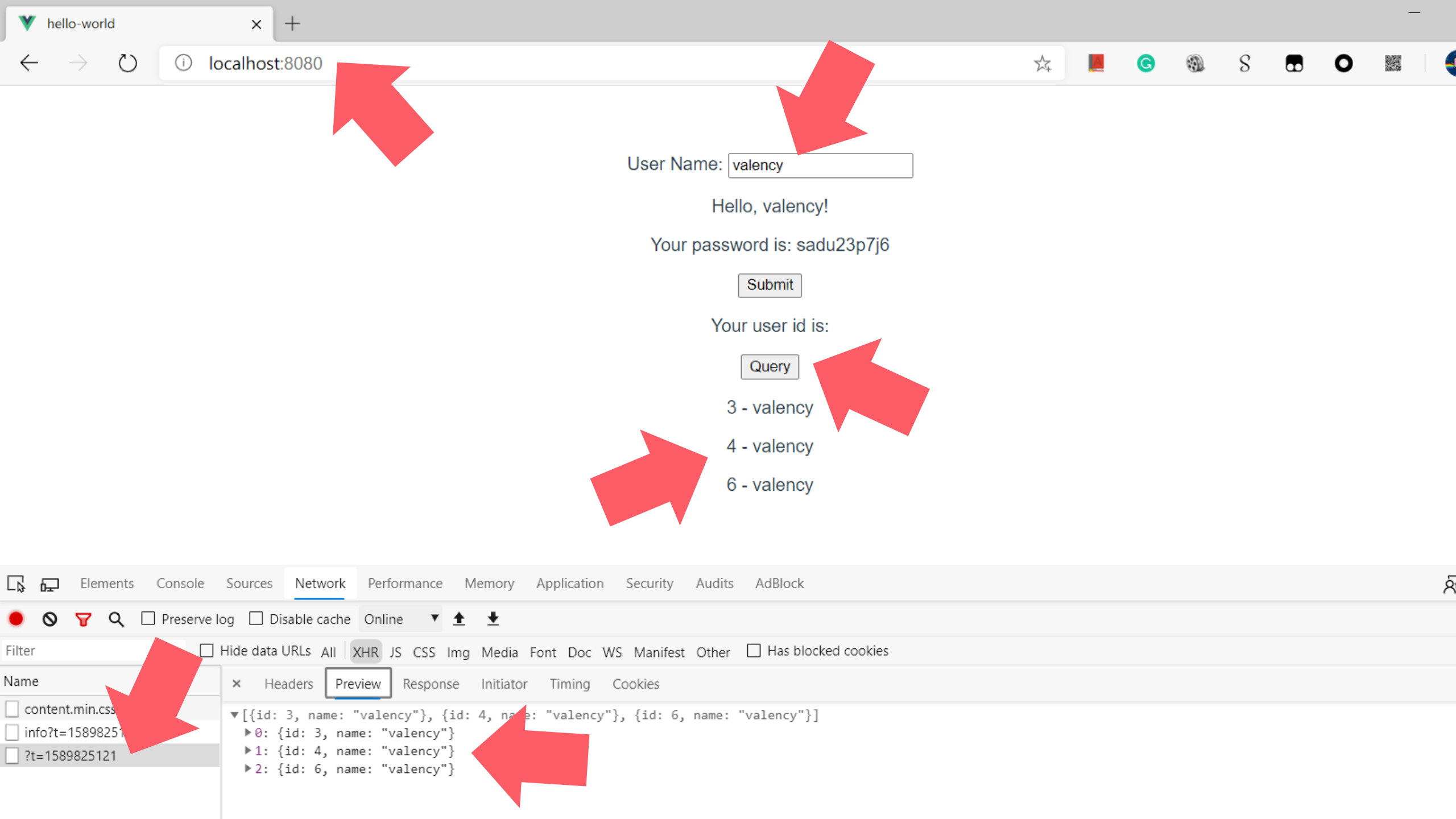
<button @click="register()">Submit</button>

Your user id is: {{uid}}

<button @click="query()">Query</button>

<p v-for="i in users" :key="i.id">{{i.id}} - {{i.name}}

</template>
<script>
const axios = require('axios').default
export default {
name: "User",
data() {
return {
user: "",
password: "",
uid: "",
users: []
}
},
methods: {
register() {...},
query() {
axios.get('/api/' + this.user + '/?t=' + ~~(new Date().getTime() / 1000)).then((res) => {
this.users = res.data
})
},
}
}
</script>


hello-world
localhost:8080
User Name: valency
Hello, valency!
Your password is: sadu23p7j6
Submit
Your user id is:
Query
3 - valency
4 - valency
6 - valency
Elements Console Sources Network Performance Memory Application Security Audits AdBlock
Preserve log Disable cache Online
Filter Hide data URLs All XHR JS CSS Img Media Font Doc WS Manifest Other Has blocked cookies
Name
content.min.css
info?t=1589825
?t=1589825121
Headers Preview Response Initiator Timing Cookies
[{id: 3, name: "valency"}, {id: 4, name: "valency"}, {id: 6, name: "valency"}]
0: {id: 3, name: "valency"}
1: {id: 4, name: "valency"}
2: {id: 6, name: "valency"}

Axios 进阶

- Axios 官网及教程：
- https://github.com/axios/axios

- Vue CLI 官网关于代理的教程：
- https://cli.vuejs.org/config/#devserver-proxy

- Vue 使用的代理模块（http-proxy-middleware）：
- https://github.com/chimurai/http-proxy-middleware

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4 常见的 UI 组件库

常见的 UI 组件库

Ant Design

- Ant Design
- https://ant.design/

- Ant Design of Vue
- https://www.antdv.com/docs/vue/introduce-cn/

- 蚂蚁金服（支付宝）的 UI 组件
- 非常适合 PC 端互联网应用程序

常见的 UI 组件库

Ant Design

常见的 UI 组件库

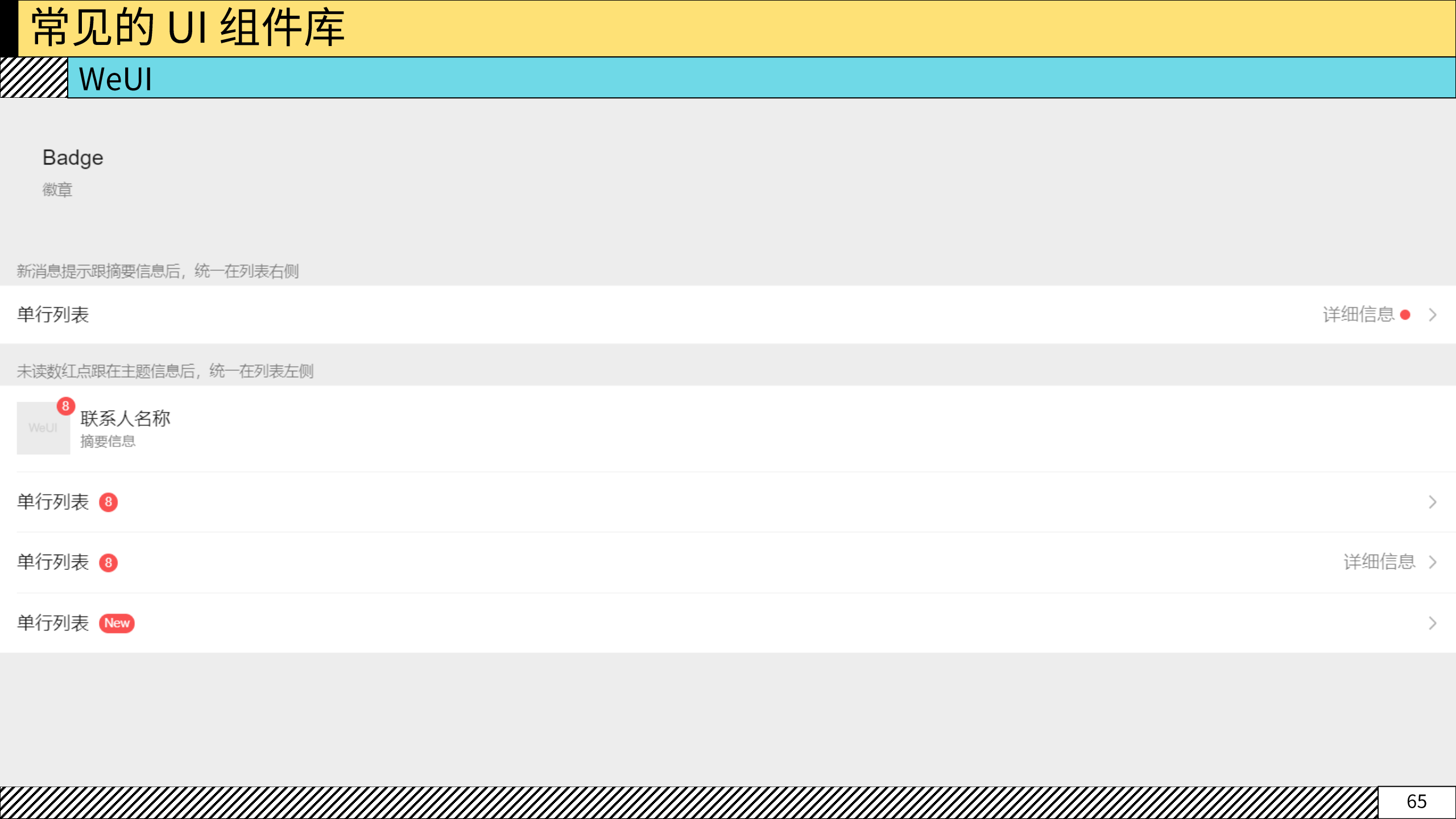
WeUI

- WeUI
- https://weui.io/
- https://github.com/Tencent/weui/blob/master/README_cn.md
- 微信官方设计团队为微信内网页和微信小程序量身设计
- 非常适合移动端互联网应用程序

- VUX
- https://vux.li/
- WeUI 的非官方 Vue.js 版本

常见的 UI 组件库

WeUI



常见的 UI 组件库

Canvas

- Canvas
- https://www.w3schools.com/html/html5_canvas.asp

- HTML 的绘图标签，可以绘制各种矢量图，例如棋盘

The HTML `<canvas>` element is used to draw graphics on a web page.

The graphic to the left is created with `<canvas>`. It shows four elements: a red rectangle, a gradient rectangle, a multicolor rectangle, and a multicolor text.

总结

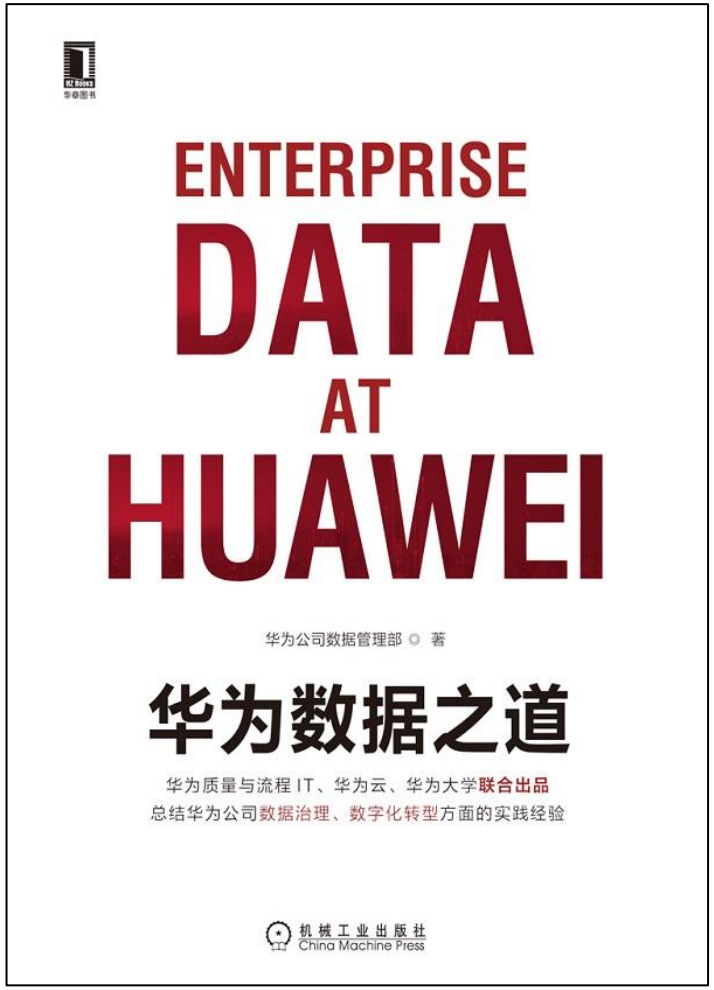
Google Cloud
cloud.google.com

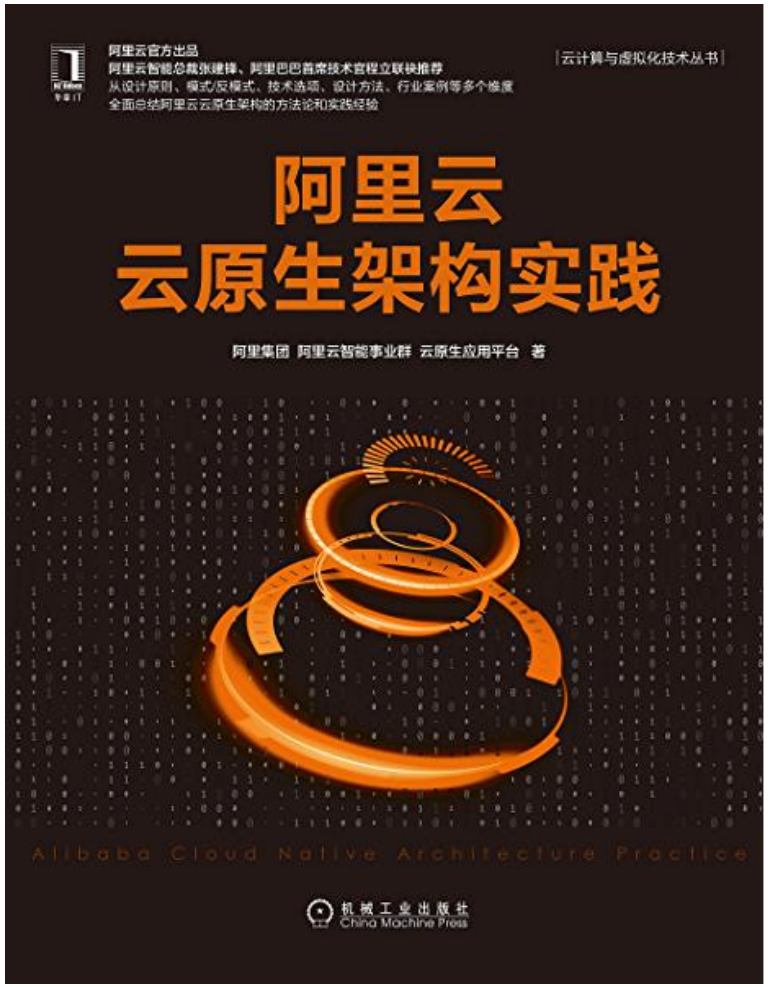
Amazon Web Services
aws.amazon.com

阿里云
aliyun.com

总结

大数据技术与应用专业规划教材
AWS-教育部-AWS产学合作专业综合改革项目规划教材
云计算与大数据
技术理论及应用
林伟伟 彭绍亮 编著
清华大学出版社


ENTERPRISE
DATA
AT
HUAWEI
华为公司数据管理部 著
华为数据之道
华为质量与流程IT、华为云、华为大学联合出品
总结华为公司数据治理、数字化转型方面的实践经验
机械工业出版社
China Machine Press


阿里云官方出品
阿里云智能总裁张建锋、阿里巴巴首席技术官程立联袂推荐
从设计原则、模式/反模式、技术选项、设计方法、行业案例等多个维度
全面总结阿里云云原生架构的方法论和实践经验
云计算与虚拟化技术丛书
阿里云
云原生架构实践
阿里集团 阿里云智能事业群 云原生应用平台 著
Alibaba Cloud Native Architecture Practice
机械工业出版社
China Machine Press

THANK YOU