TypeScript学习笔记

TypeScript

概述

TypeScript是微软开发的一个开源的编程语言，通过在JavaScript的基础上添加静态类型定义构建而成。TypeScript通过TypeScript编译器或Babel转译为JavaScript代码，可运行在任何浏览器，任何操作系统。

TypeScript 起源于使用JavaScript开发的大型项目 。由于JavaScript语言本身的局限性，难以胜任大型项目的开发和维护。因此微软开发了TypeScript ，使得其能够胜任大型项目的开发。

TypeScript可以在任何浏览器运行、任何计算机和任何操作系统上运行，并且是开源的

TypeScript与js相比的优势：

- TypeScript工具使重构更变的容易、快捷。
- TypeScript 引入了 JavaScript 中没有的“类”概念。
- TypeScript 中引入了模块的概念，可以把声明、数据、函数和类封装在模块中
- 类型安全功能能在编码期间检测错误，这为开发人员创建了一个更高效的编码和调试过程。

官网

网站首页：https://www.tslang.cn/index.html

文档地址：https://www.tslang.cn/docs/home.html

安装

npm全局安装：

```
npm install -g typescript
```

也可以指定版本：

```
npm install -g typescript@4.1.5
```

```
PS C:\Users\mao\Desktop> npm install -g typescript@4.1.5
C:\Users\mao\AppData\Roaming\npm\tsc ->
C:\Users\mao\AppData\Roaming\npm\node_modules\typescript\bin\tsc
C:\Users\mao\AppData\Roaming\npm\tsserver ->
C:\Users\mao\AppData\Roaming\npm\node_modules\typescript\bin\tsserver
+ typescript@4.1.5
updated 1 package in 10.618s
PS C:\Users\mao\Desktop> tsc -v
Version 4.1.5
PS C:\Users\mao\Desktop>
```

```
PS C:\Users\mao\Desktop> tsc --help
Version 4.1.5
Syntax:   tsc [options] [file...]

Examples: tsc hello.ts
          tsc --outFile file.js file.ts
          tsc @args.txt
          tsc --build tsconfig.json

Options:
 -h, --help                                         Print this message.
 -w, --watch                                        Watch input files.
 --pretty                                           Stylize errors and
messages using color and context (experimental).
 --all                                              Show all compiler
options.
 -v, --version                                      Print the compiler's
version.
 --init                                             Initializes a TypeScript
project and creates a tsconfig.json file.
 -p FILE OR DIRECTORY, --project FILE OR DIRECTORY  Compile the project
given the path to its configuration file, or to a folder with a
'tsconfig.json'.
 -b, --build                                        Build one or more
projects and their dependencies, if out of date
 -t VERSION, --target VERSION                       Specify ECMAScript
target version: 'ES3' (default), 'ES5', 'ES2015', 'ES2016', 'ES2017',
'ES2018', 'ES2019', 'ES2020', or 'ESNEXT'.
 -m KIND, --module KIND                             Specify module code
generation: 'none', 'commonjs', 'amd', 'system', 'umd', 'es2015', 'es2020',
or 'ESNext'.
 --lib                                              Specify library files to
be included in the compilation.
```

```
                                                'es5' 'es6' 'es2015'
'es7' 'es2016' 'es2017' 'es2018' 'es2019' 'es2020' 'esnext' 'dom'
'dom.iterable' 'webworker' 'webworker.importscripts' 'webworker.iterable'
'scripthost' 'es2015.core' 'es2015.collection' 'es2015.generator'
'es2015.iterable' 'es2015.promise' 'es2015.proxy' 'es2015.reflect'
'es2015.symbol' 'es2015.symbol.wellknown' 'es2016.array.include'
'es2017.object' 'es2017.sharedmemory' 'es2017.string' 'es2017.intl'
'es2017.typedarrays' 'es2018.asyncgenerator' 'es2018.asynciterable'
'es2018.intl' 'es2018.promise' 'es2018.regexp' 'es2019.array'
'es2019.object' 'es2019.string' 'es2019.symbol' 'es2020.bigint'
'es2020.promise' 'es2020.sharedmemory' 'es2020.string'
'es2020.symbol.wellknown' 'es2020.intl' 'esnext.array' 'esnext.symbol'
'esnext.asynciterable' 'esnext.intl' 'esnext.bigint' 'esnext.string'
'esnext.promise' 'esnext.weakref'
 --allowJs                                      Allow javascript files
to be compiled.
 --jsx KIND                                     Specify JSX code
generation: 'preserve', 'react-native', or 'react'.
 -d, --declaration                              Generates corresponding
'.d.ts' file.
 --declarationMap                               Generates a sourcemap
for each corresponding '.d.ts' file.
 --sourceMap                                    Generates corresponding
'.map' file.
 --outFile FILE                                 Concatenate and emit
output to single file.
 --outDir DIRECTORY                             Redirect output
structure to the directory.
 --removeComments                               Do not emit comments to
output.
 --noEmit                                       Do not emit outputs.
 --strict                                       Enable all strict type-
checking options.
 --noImplicitAny                                Raise error on
expressions and declarations with an implied 'any' type.
 --strictNullChecks                             Enable strict null
checks.
 --strictFunctionTypes                          Enable strict checking
of function types.
 --strictBindCallApply                          Enable strict 'bind',
'call', and 'apply' methods on functions.
 --strictPropertyInitialization                 Enable strict checking
of property initialization in classes.
 --noImplicitThis                               Raise error on 'this'
expressions with an implied 'any' type.
 --alwaysStrict                                 Parse in strict mode and
emit "use strict" for each source file.
 --noUnusedLocals                               Report errors on unused
locals.
 --noUnusedParameters                           Report errors on unused
parameters.
 --noImplicitReturns                            Report error when not
all code paths in function return a value.
 --noFallthroughCasesInSwitch                   Report errors for
fallthrough cases in switch statement.
```

```
 --types                                              Type declaration files to be included in compilation.
 --esModuleInterop                                    Enables emit interoperability between CommonJS and ES Modules via creation of namespace objects for all imports. Implies 'allowSyntheticDefaultImports'.
 @<file>                                              Insert command line options and files from a file.
PS C:\Users\mao\Desktop>
```

动态类型的问题

js 属于动态类型语言

如下一个函数：

```
function test(obj) {
}
```

传递过去的参数可能是一个字符串：

```
test('hello, world')
```

也可能是一个对象：

```
test({a:1,b:2})
```

也有可能是个函数：

```
test(()=>{})
```

obj 类型不确定，就给后期使用者带来了麻烦，一旦参数传不对，代码可能出现问题

动态类型是在代码运行时才知道是什么

静态类型是在代码运行前，就对它的行为做出预测

在Vue中使用ts

全新项目：使用vue cli脚手架工具创建vue项目时，勾选 ts

已有项目：添加vue官方配置的ts适配插件，使用@vue/cli 安装 ts插件

```
vue add @vue/typescript
```

或者手动安装：

```
npm install ts-loader typescript tslint tslint-loader tslint-config-standard --save-dev
```

```
npm install vue-class-component vue-property-decorator --save
```

- vue-class-component：扩展vue支持typescript，将原有的vue语法通过声明的方式来支持ts
- vue-property-decorator：基于vue-class-component扩展更多装饰器
- ts-loader：让webpack能够识别ts文件
- tslint-loader：tslint用来约束文件编码
- tslint-config-standard： tslint 配置 standard风格的约束

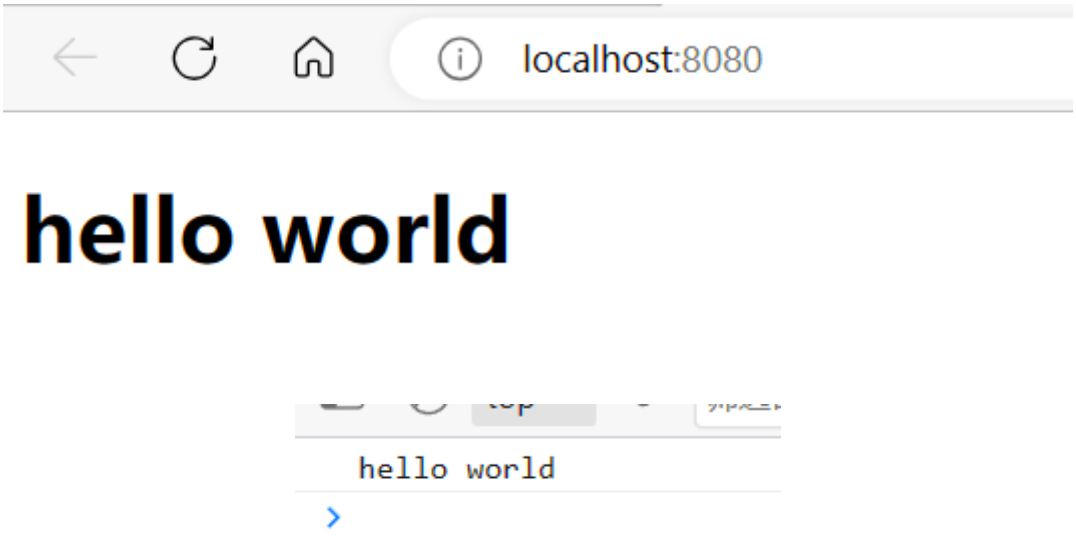
在vue中使用要加上`lang="ts"`

```
<template>

</template>

<script lang="ts">
export default {
  name: "View1",
}
</script>

<style scoped>

</style>
```

入门

输出helloworld，并打印显示helloworld

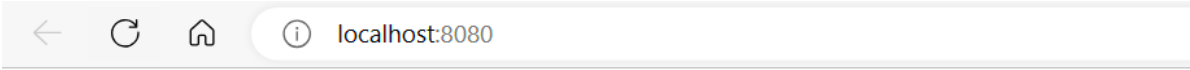
```
<template>
  <div>
    <h1>{{ str }}</h1>
  </div>
</template>

<script setup lang="ts">

const str: string = 'hello world';

function hello(str: string)
{
  console.log(str);
}

hello(str);


</script>

<style scoped>

</style>
```



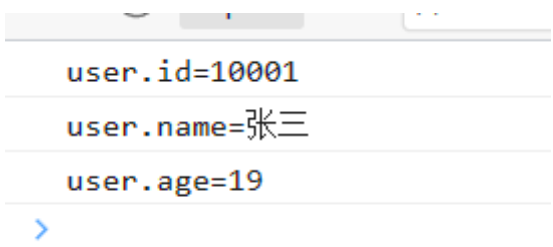
用 interface 定义用户类型：

```
<template>
  <div>
```

```
    <h1>{{ user }}</h1>
  </div>
</template>

<script setup lang="ts">
interface User
{
  id: number
  name: string,
  age: number,
}

function printUser(user: User): void
{
  console.log("user.id=" + user.id)
  console.log("user.name=" + user.name)
  console.log("user.age=" + user.age)
}

const user: User = {
  id: 10001,
  name: '张三',
  age: 19
}

printUser(user);

</script>

<style scoped>

</style>
```



{ "id": 10001, "name": "张三", "age": 19 }



类型

类型	例	备注
字符串类型	string	
数字类型	number	
布尔类型	boolean	
数组类型	number[],string[], boolean[] 依此类推	
任意类型	any	相当于又回到了没有类型的时代
复杂类型	type 与 interface	
函数类型	() => void	对函数的参数和返回值进行说明
字面量类型	"a"|"b"|"c"	限制变量或参数的取值
nullish类型	null 与 undefined	
泛型	`<T>`，`<T extends 父类型>`	

类型标注位置

标注变量

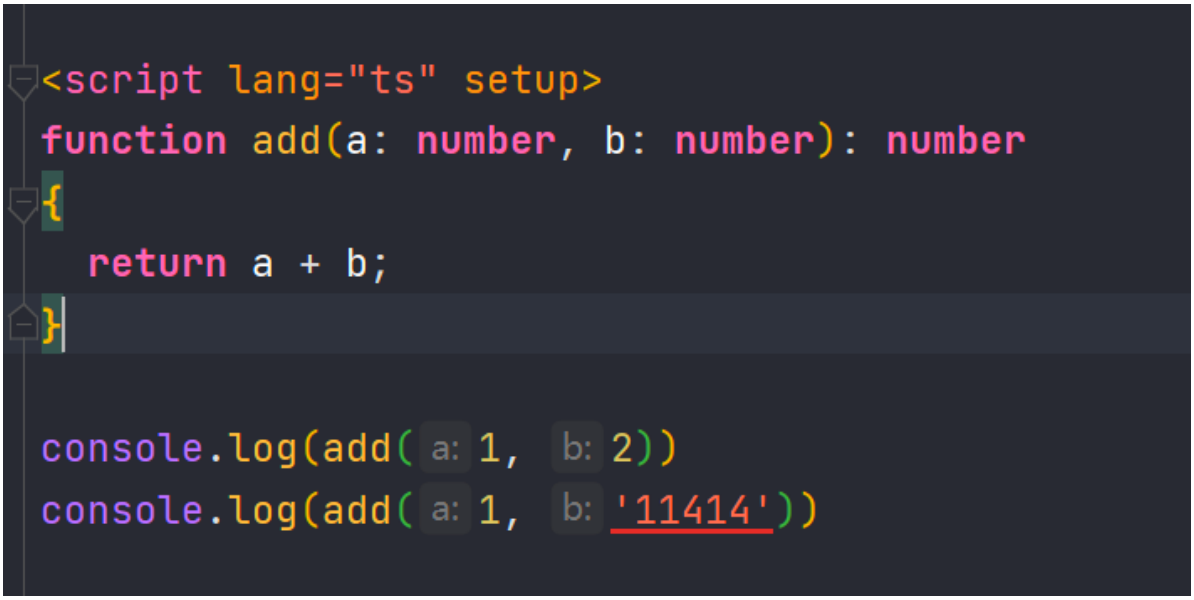
```
let message: string = 'hello,world'
```

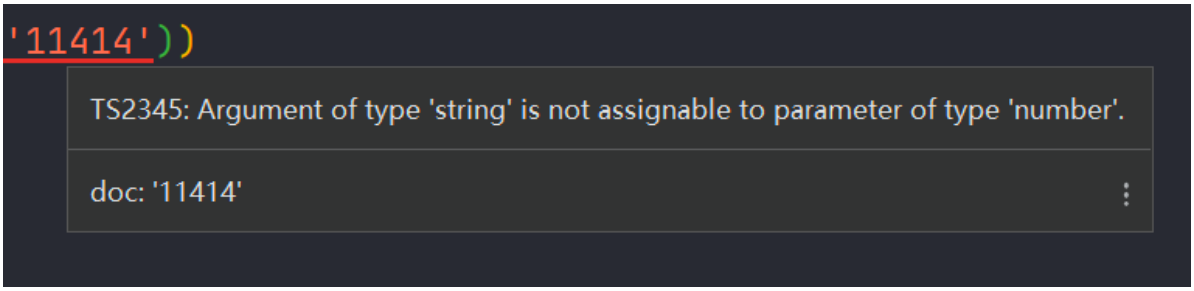
一般可以省略，因为可以根据后面的字面量推断出前面变量类型

```
let message = 'hello,world'
```

标注参数

```
function test(name: string) {

}
```





标注返回值

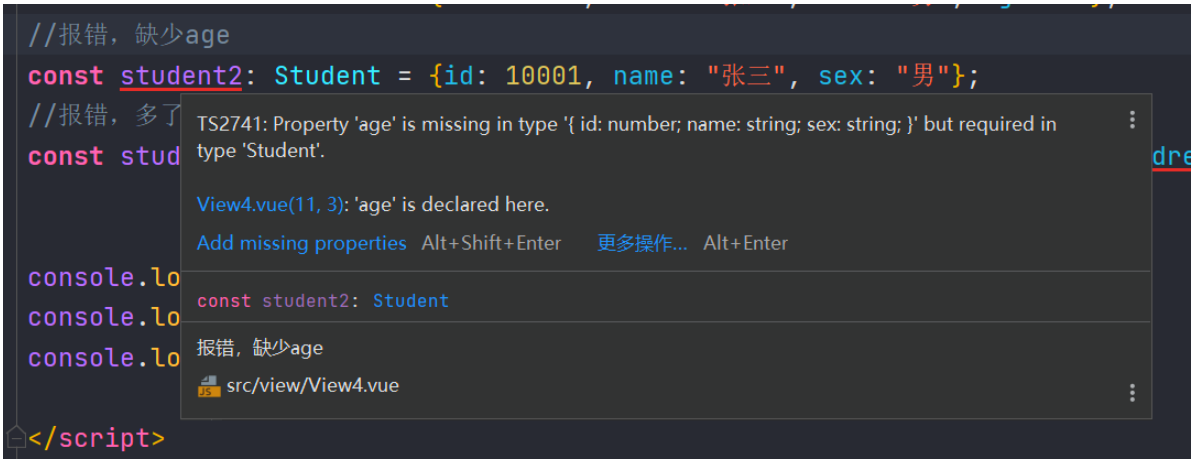
```
<template>

</template>

<script lang="ts" setup>
function add(a: number, b: number): number
{
  return a + b;
}

console.log(add(1, 2))

</script>

```

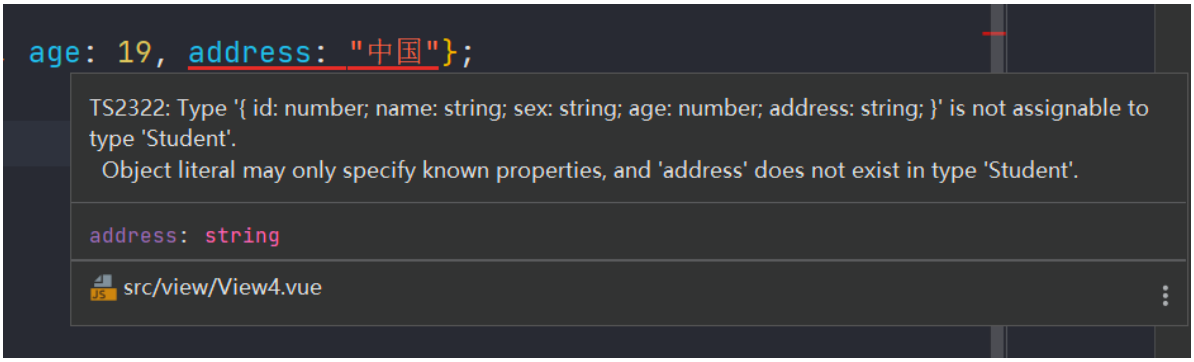
```
<style scoped>

</style>
```

复杂类型

type

```
<template>

</template>

<script lang="ts" setup>

type Student = {
  id: number,
  name: string,
  sex: string,
  age: number
}
const student1: Student = {id: 10001, name: "张三", sex: "男", age: 19};
//报错，缺少age
const student2: Student = {id: 10001, name: "张三", sex: "男"};
//报错，多了address
const student3: Student = {id: 10001, name: "张三", sex: "男", age: 19,
address: "中国"};


console.log(student1);
console.log(student2);
console.log(student3);

</script>

<style scoped>

</style>
```





interface

和type区别在于，少了一个等号

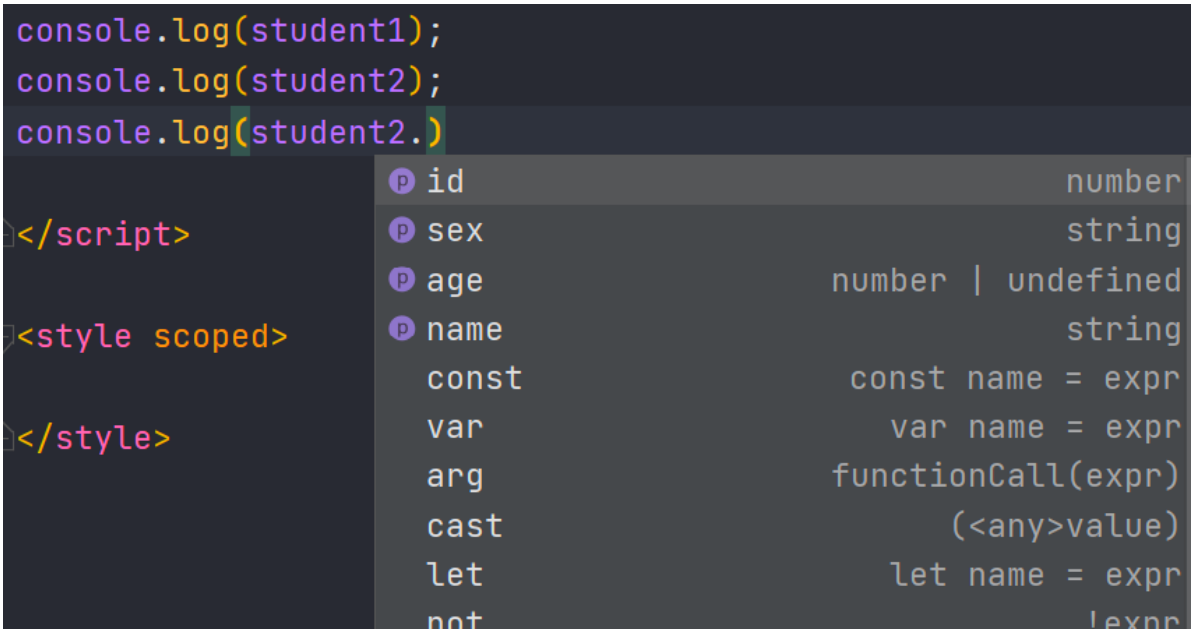
```vue
<template>

</template>

<script lang="ts" setup>

interface Student
{
  id: number,
  name: string,
  sex: string,
  age: number
}

const student1: Student = {id: 10001, name: "张三", sex: "男", age: 19};
//报错，缺少age
const student2: Student = {id: 10001, name: "张三", sex: "男"};
//报错，多了address
```

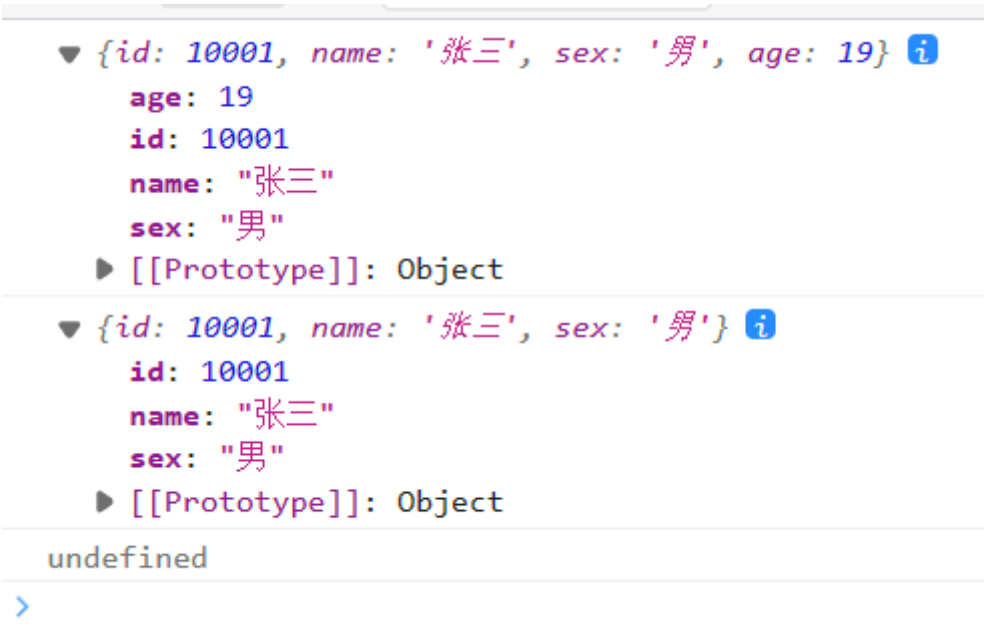
```
const student3: Student = {id: 10001, name: "张三", sex: "男", age: 19,
address: "中国"};


console.log(student1);
console.log(student2);
console.log(student3);

</script>

<style scoped>

</style>
```

可选属性

如果需要某个属性可选，可以用下面的语法

```
<template>

</template>

<script lang="ts" setup>

interface Student
{
  id: number,
  name: string,
  sex: string,
  age?: number
}

const student1: Student = {id: 10001, name: "张三", sex: "男", age: 19};
//并不会报错，缺少age，但是会出现undefined
const student2: Student = {id: 10001, name: "张三", sex: "男"};
console.log(student1);
console.log(student2);
console.log(student2.age)

</script>

<style scoped>

</style>

```





鸭子类型

```
<template>

</template>

<script lang="ts" setup>

interface Student
{
  id: number,
  name: string,
  sex: string,
```

```
  age: number
}

const student1: Student = {id: 10001, name: "张三", sex: "男", age: 19};

//报错，多了address
//const student3: Student = {id: 10001, name: "张三", sex: "男", age: 19, address: "中国"};

const student3 = {id: 10001, name: "张三", sex: "男", age: 19, address: "中国"};
//鸭子类型，student3并没有声明类型为Student，但它与 Student 类型有一样的属性，也可以被当作是 Student 类型

console.log(student1);
console.log(student3);

</script>

<style scoped>

</style>
```

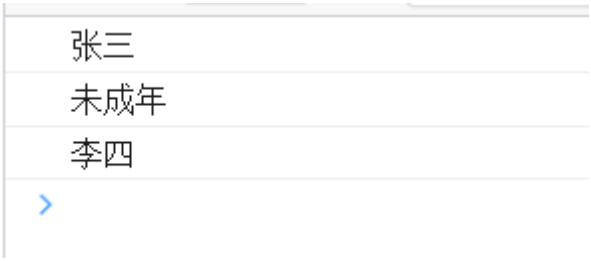
student3并没有声明类型为Student，但它与 Student 类型有一样的属性，也可以被当作是 Student 类型

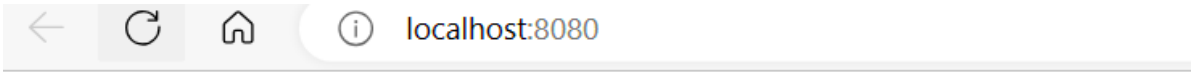
方法类型

interface中包含方法（函数）

```
<template>
  <div>
    <h2>{{ user }}</h2>
  </div>
</template>

<script lang="ts" setup>

import {onBeforeMount, onMounted} from "vue";

interface User
{
  id: number,
  name: string,
  age: number,

  getName(): string

```

```
  getAgeString(): string

  setName(name: string): void
}

const user: User = {
  id: 10002,
  name: "张三",
  age: 12,
  getName(): string
  {
    return this.name
  },
  getAgeString(): string
  {
    if (this.age < 0 || this.age > 120)
    {
      return "年龄输入错误"
    }
    if (this.age < 18)
    {
      return "未成年";
    }
    if (this.age < 30)
    {
      return "青年"
    }
    if (this.age < 60)
    {
      return "中年"
    }
    return "老年"
  },
  setName(name: string)
  {
    this.name = name;
  }
}

onBeforeMount(()=>
{
  console.log(user.getName())
  console.log(user.getAgeString())
  user.setName("李四")
  console.log(user.getName())
})

</script>

<style scoped>

</style>
```



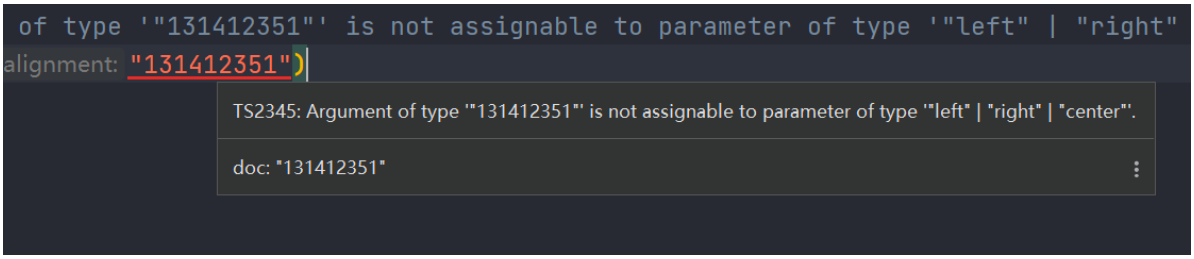


{ "id": 10002, "name": "李四", "age": 12 }

字面量类型

```
<template>
  <div>

  </div>
</template>

<script lang="ts" setup>

/**
 * 打印字符串到控制台
 * @param str 字符串
 * @param alignment 对齐方式，只能取值left、right和center
 */
function print(str: string, alignment: "left" | "right" | "center")
{
  console.log(str, alignment)
}

print("hello", "left")
print("hello", "right")
print("hello", "center")
//以下报错：Argument of type '"131412351"' is not assignable to parameter of type '"left" | "right" | "center"'
print("hello","131412351")


</script>

<style scoped>
```

```
29
30  </style>
```



nullish 类型

在冒号前面加一个问号，表示字段可以为空

```
1   <template>
2
3   </template>
4
5   <script lang="ts" setup>
6
7   interface StudentV1
8   {
9     id: number,
10    name: string,
11    sex: string,
12    age: number
13  }
14
15  interface StudentV2
16  {
17    id: number,
18    name: string,
19    sex?: string,
20    age?: number
21  }
22
23  //Property 'age' is missing in type '{ id: number; name: string; sex:
    string; }' but required in type 'StudentV1'.
24  const studentV1: StudentV1 = {id: 10001, name: "张三", sex: "男"};
25  //Type 'undefined' is not assignable to type 'number'.
26  const student2V1: StudentV1 = {id: 10001, name: "张三", sex: "男", age:
    undefined};
27  //并不会报错
28  const studentV2: StudentV2 = {id: 10001, name: "张三"};
29  const student2V2: StudentV2 = {id: 10001, name: "张三",sex:undefined};
30
```

```
console.log(studentV1)
console.log(studentV2)
console.log(student2V1)
console.log(student2V2)

</script>

<style scoped>

</style>
```

```
<template>

</template>

<script lang="ts" setup>

function toUpperCase(str?: string | null): string
{
  return str?.toUpperCase() || "无效字符串"
}

function toUpperCase2(str: string): string
{
  return str.toUpperCase()
}

console.log(toUpperCase("hello"))
console.log(toUpperCase(null))
console.log(toUpperCase())

console.log(toUpperCase2("hello2"))
//Argument of type 'null' is not assignable to parameter of type 'string'.
console.log(toUpperCase2(null))
//Expected 1 arguments, but got 0.
console.log(toUpperCase2())

</script>

<style scoped>

</style>
```

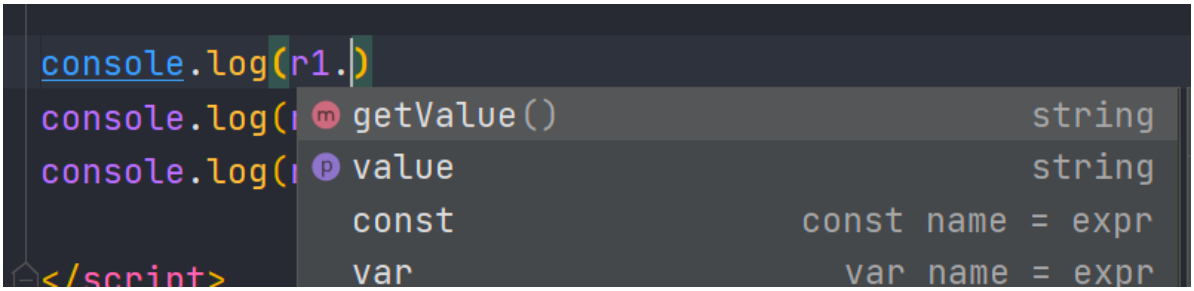
泛型

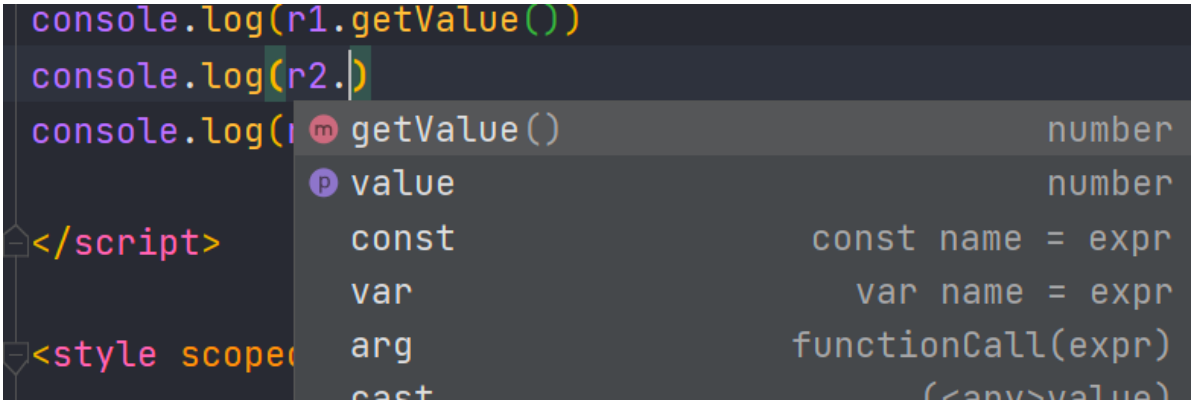
下面的几个类型声明显然有一定的相似性

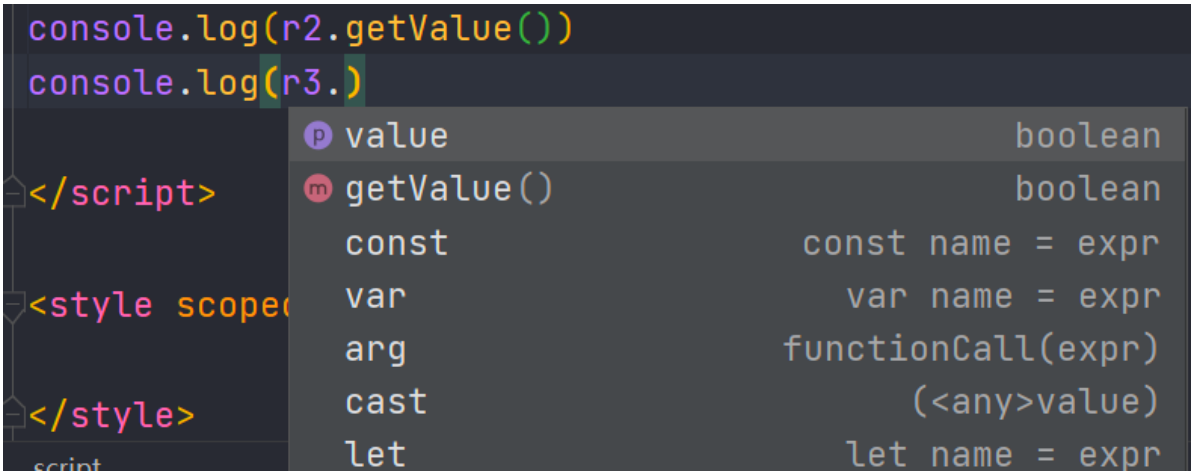
```ts
interface RefString {
  value: string
}

interface RefNumber {
  value: number
}

interface RefBoolean {
  value: boolean
}

const r1: RefString = { value: 'hello' }
const r2: RefNumber = { value: 123 }
const r3: RefBoolean = { value: true }
```

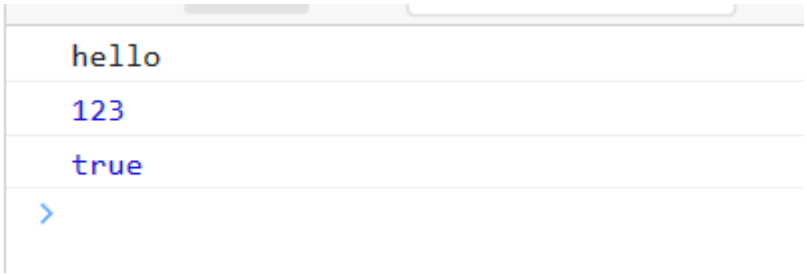
可以改进为：

```
<template>

</template>

<script lang="ts" setup>

interface Ref<T>
{
  value: T,

  /**
   * 得到value值
   */
  getValue(): T
}

const r1: Ref<string> = {
  value: 'hello', getValue()
  {
    return this.value
  }
}
const r2: Ref<number> = {
  value: 123, getValue()
  {
    return this.value
  }
}
const r3: Ref<boolean> = {
  value: true, getValue()
  {
    return this.value
  }
}

console.log(r1.getValue())
console.log(r2.getValue())
console.log(r3.getValue())

</script>

<style scoped>

</style>
```









函数定义也支持泛型：

```
1 <template>
```

```
2
3  </template>
4
5  <script lang="ts" setup>
6
7  function ref<T>(arg: T): T
8  {
9    return arg;
10 }
11
12 console.log(ref("hello"))
13 console.log(ref(12345))
14 console.log(ref(true))
15 console.log(ref(null))
16 console.log(ref(undefined))
17
18 console.log(typeof ref("hello"))
19 console.log(typeof ref(12345))
20 console.log(typeof ref(true))
21 console.log(typeof ref(null))
22 console.log(typeof ref(undefined))
23
24 </script>
25
26 <style scoped>
27
28 </style>
```

```
hello
12345
true
null
undefined
string
number
boolean
object
undefined
>
```

类

基本语法

```
<template>
  <div>
    <h2>{{stu1}}</h2>
    <h2>{{stu2}}</h2>
    <h2>{{stu3}}</h2>
    <h2>{{stu4}}</h2>


  </div>
</template>

<script setup lang="ts">

/**
 * 学生类
 */
class Student
{
  /**
   * id
   */
  id: number;
  /**
   * 姓名
   */
  name: string;
  /**
   * 性别
   */
  sex: string;


  /**
   * 无参构造方法
   */
  constructor();
  /**
   *
   * @param id 学生学号
   */
  constructor(id: number);
  /**
   *
   * @param id 学生学号
   * @param name 姓名
```

```
     */
    constructor(id: number, name: string);
    /**
     *
     * @param id 学生学号
     * @param name 姓名
     * @param sex 性别
     */
    constructor(id: number, name: string, sex: string);
    /**
     *
     * @param id 学生学号
     * @param name 姓名
     * @param sex 性别
     */
    constructor(id?: number, name?: string, sex?: string)
    {
      console.log("构造方法被调用了")
      this.id = id ? id : 10001
      this.name = name ? name : "张三"
      this.sex = sex ? sex : "男"
    }
}

const stu1: Student = new Student()
console.log(stu1)

const stu2: Student = new Student(102222)
console.log(stu2)

const stu3: Student = new Student(102223, "李四")
console.log(stu3)

const stu4: Student = new Student(102224, "王五", '女')
console.log(stu4)

console.log(stu4.name)

</script>

<style scoped>

</style>

```

{ "id": 10001, "name": "张三", "sex": "男" }

{ "id": 102222, "name": "张三", "sex": "男" }

{ "id": 102223, "name": "李四", "sex": "男" }

{ "id": 102224, "name": "王五", "sex": "女" }

js 中的 class，并不等价于 java 中的 class，它还是基于原型实现的

访问修饰符

有三类:

- public
- protected
- private

默认为 public，可以自由的访问程序里定义的成员

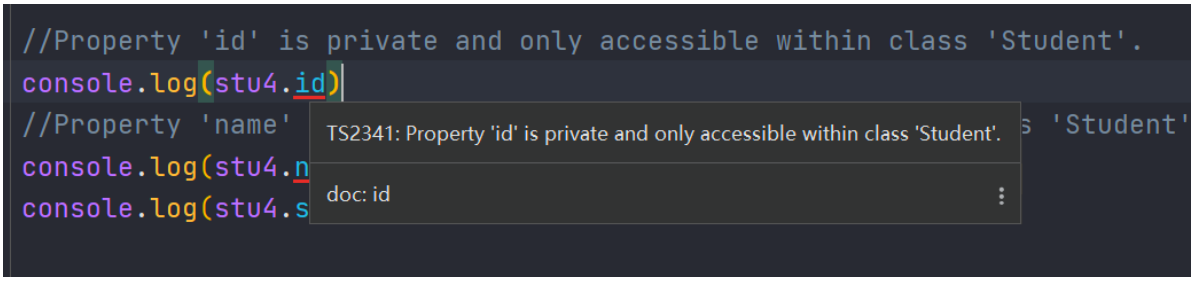
当成员被标记成 private时，它就不能在声明它的类的外部访问

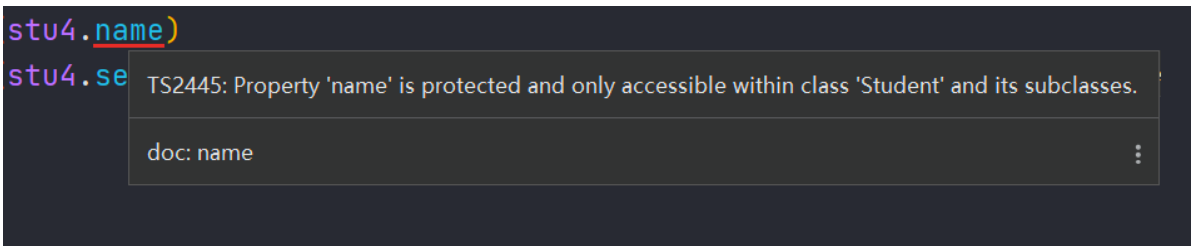
protected修饰符与 private修饰符的行为很相似，但有一点不同， protected成员在派生类中仍然可以访问

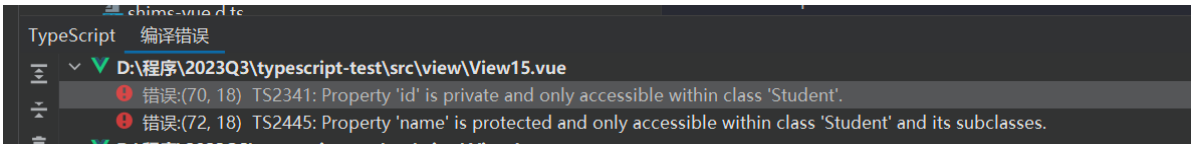
可以参考java

```
<template>
  <div>
    <h2>{{ stu4 }}</h2>
  </div>
</template>

<script setup lang="ts">

/**
 * 学生类
 */
class Student
{
  /**
   * id
   */
  private id: number;
  /**
   * 姓名
   */
  protected name: string;
  /**
   * 性别
   */
  public sex: string;


  /**
   * 无参构造方法
   */
  constructor();
  /**
   *
   * @param id 学生学号
   */
  constructor(id: number);
  /**
   *
   * @param id 学生学号
   * @param name 姓名
   */
  constructor(id: number, name: string);
  /**
   *
   * @param id 学生学号
   * @param name 姓名
   * @param sex 性别
```

```
48      */
49      constructor(id: number, name: string, sex: string);
50      /**
51       *
52       * @param id 学生学号
53       * @param name 姓名
54       * @param sex 性别
55       */
56      constructor(id?: number, name?: string, sex?: string)
57      {
58          console.log("构造方法被调用了")
59          this.id = id ? id : 10001
60          this.name = name ? name : "张三"
61          this.sex = sex ? sex : "男"
62      }
63  }
64
65  const stu4: Student = new Student(102224, "王五", '女')
66
67  console.log(stu4)
68
69  //Property 'id' is private and only accessible within class 'Student'.
70  console.log(stu4.id)
71  //Property 'name' is protected and only accessible within class 'Student'
    and its subclasses.
72  console.log(stu4.name)
73  console.log(stu4.sex)
74
75  </script>
76
77  <style scoped>
78
79  </style>
```







只读属性

readonly 是 typescript 特有的，表示该属性只读

```
<template>

</template>

<script lang="ts" setup>

class User
{
  /**
   * 用户编号，只读
   */
  readonly id: number;
  /**
   * 用户名称
   */
  name: string | undefined;

  constructor()
  {
    this.id = 10001;
  }
}

const user: User = new User();
//Cannot assign to 'id' because it is a read-only property.
user.id = 10002;
user.name = "张三";

console.log(user.id)
console.log(user.name)

</script>

<style scoped>

</style>
```

方法

```
<template>

</template>

<script lang="ts" setup>

class User
{
  /**
   * 用户编号，只读
   */
  readonly id: number;
  /**
   * 用户名称
   */
  name: string | undefined;

  constructor()
  {
    this.id = 10001;
  }

  /**
   * 转字符串
   */
  toString()
  {
    return "用户编号：" + this.id + ",用户名称：" + this.name
  }

```

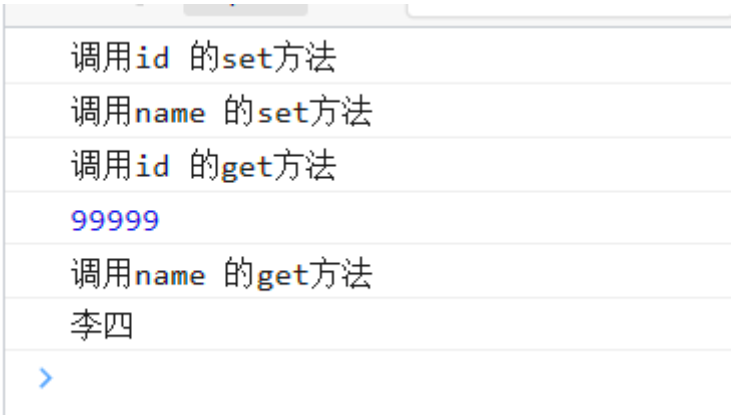
```
  /**
   * 转json
   */
  toJson()
  {
    return JSON.stringify(this);
  }

}

const user: User = new User();
user.name = "张三";

console.log(user.id)
console.log(user.name)

console.log(user.toString())
console.log(user.toJson())

</script>

<style scoped>

</style>
```

```
10001
张三
用户编号：10001,用户名称：张三
{"id":10001,"name":"张三"}
>
```

get和set

```
<template>

</template>

<script setup lang="ts">

class Student
{
  private _id: number;
  private _name: string;

  get name(): string
  {
```

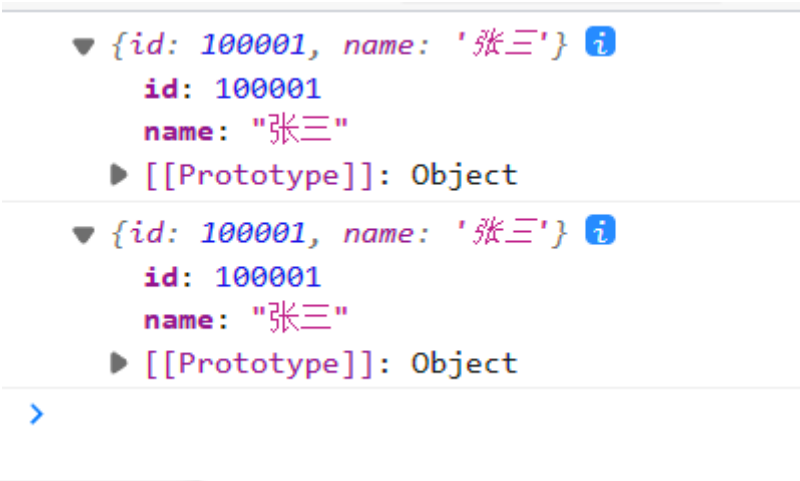
```
    console.log("调用name 的get方法")
    return this._name;
  }

  set name(value: string)
  {
    console.log("调用name 的set方法")
    this._name = value;
  }

  get id(): number
  {
    console.log("调用id 的get方法")

    return this._id;
  }

  set id(value: number)
  {
    console.log("调用id 的set方法")
    this._id = value;
  }

  constructor()
  {
    this._id = 10001
    this._name = "";
  }
}

const student: Student = new Student();

//Property '_id' is private and only accessible within class 'Student'.
//console.log(student._id)
//Property '_name' is private and only accessible within class 'Student'.
//console.log(student._name)

student.id = 99999;
student.name = "李四"

console.log(student.id)
console.log(student.name)

</script>

<style scoped>

</style>
```

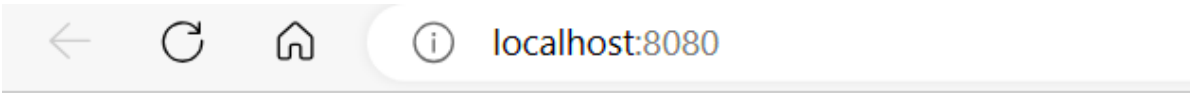


类与接口

```vue
<template>
  <div>
    <h2>
      {{userService.getLoginUser()}}
    </h2>
  </div>
</template>

<script setup lang="ts">

/**
 * 实体类
 */
interface User
{
  id: number;
  name: string;
}

/**
 * 接口
 */
interface UserService
{
  /**
   * 登录
   */
  login(user: User): void

  /**
   * 得到当前登录人的信息
   */
  getLoginUser(): User
}

/**
```

```
 * 实现类
 */
class UserServiceImpl implements UserService
{
  getLoginUser(): User
  {
    return {id: 100001, name: '张三'};
  }

  login(user: User): void
  {
    console.log(user)
  }
}

const userService: UserService = new UserServiceImpl();

const loginUser = userService.getLoginUser();
console.log(loginUser)
userService.login(loginUser);

console.log()

</script>

<style scoped>

</style>
```

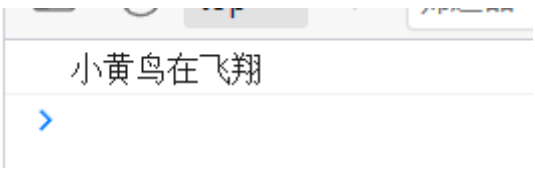




{ "id": 100001, "name": "张三" }

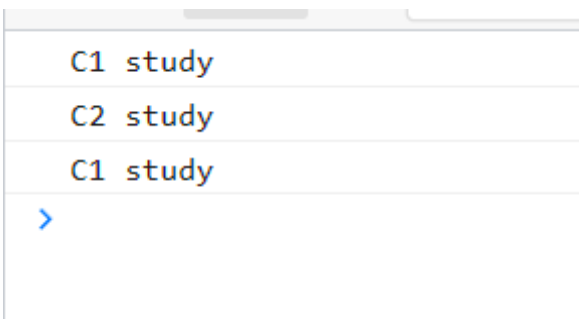
继承与接口

```
<template>
  <div>
  </div>
</template>

<script setup lang="ts">

interface Flyable
{
  fly(): void
}

class Animal
{
  name: string;

  constructor(name: string)
  {
    this.name = name
  }
}

class Bird extends Animal implements Flyable
{
  fly()
  {
    console.log(`${this.name}在飞翔`)
  }
}

const b: Flyable & Animal = new Bird("小黄鸟")
b.fly()

</script>

<style scoped>

</style>
```



方法重写

```
<template>
  <div>
  </div>
</template>

<script setup lang="ts">

class C1
{
  study()
  {
    console.log("C1 study")
  }
}

class C2 extends C1
{
  study()
  {
    super.study();
    console.log("C2 study")
  }
}

let c: C1 = new C2()
c.study();

c = new C1()
c.study();


</script>

<style scoped>

</style>
```



end

2023 06 29