Fullstack Development


JS

History

- https://roadmap.sh/guides/history-of-javascript
- https://www.w3schools.com/js/js_versions.asp

Where is `JS`?

- Browser
  - Manipulate DOM.
- Host OS
  - JavaScript runtimes (NodeJS, Bun)

Activity

- Run `console.log` in a browser and in an OS.

Learning JS

- https://roadmap.sh/javascript
- https://roadmap.sh/questions/javascript


TS
TypeScript

What is TypeScript?

- TypeScript is a super set of JavaScript.

Why TypeScipt?

- Improves your productivity while helping avoid bugs.
  - Catch bugs at the compile-time instead of at runtime.
- Brings the future JavaScript to today.
  - You can use the new JavaScript features before web browsers (or other environments) fully support them.
- More competitive in job market.

How it works?

1. Write TypeScript codes. (`.ts` files)
2. Compile the TypeScript codes into plain JavaScript codes (`.js` files) using a TypeScript compiler.
3. Run JavaScript codes in an environment that JavaScript runs.

Tools

- TypeScript Playground: https://www.typescriptlang.org/play
- VSCode Extension
  - `Quokka.js`
    - 2025-06-27: Too many ads. Consider TypeScript Worksheet.
  - `Pretty TypeScript Errors`

Demo

```ts
let a = 10;
a.slice(0, 1); // See error message
```

```ts
let a: number;
a = "Hello"; // See error message
```

```ts
let a: number;
// Try typing "a" and trigger intellisense.
```

Defining types

- Types by inference
  - TypeScript knows the JavaScript language and will generate types for you in many cases.
- Type by specification
  - We define it ourselves.
  - Keywords `type`, `interface`

Type by inference

```
const user = {
  name: "Hayes",
  id: 0,
};

user.name = 20; // Error
console.log(user.food); // Error
```

- TypeScript already knows the type of this variable.

Type by specification

```
interface User {
  name: string;
  id: number;
}
```

or

```
type User = {
  name: string;
  id: number;
};
```

Type Annotation

```ts
interface User {
  name: string;
  id: number;
}

// type User = {
//   name: string;
//   id: number;
// };

const user: User = {
  name: "Hayes",
  id: 0,
  age: 30, // Error
};
```

`type` vs `interface`

- They are very similar, and for the most common cases act the same.
- However, TypeScript doc recommends `interface`.
  - `interface` provides better error message.
  - `interface` can be extended.

More type demo

- https://github.com/fullstack-68/typescript-intro/blob/main/lecture/03_more_type_demo.ts

Type utilities

```
interface User {
  id: number;
  name: string;
}

// Extend
interface UserExtended extends User {
  isActive: boolean;
}
```

More information

Function (argument type)

```
// Give warning
function sumNumber(a, b) {
  return a + b;
}

// OK
function sumNumber(a: number, b: number) {
  return a + b;
}
```

Function (type guards)

```
// Hover cursor on "text" to see the type
function greeter(text: string | null | undefined) {
  if (!text) {
    console.log("...");
    return;
  }
  console.log(text);
}
```

Generics

Generics provide variables to types.

```
interface Backpack<Type> {
  items: Type[];
  add: (obj: Type) => void;
  get: () => Type;
}

const backpack: Backpack<string> = {
  items: ["1", "2"],
  add: (myStr) => {
    myStr.slice(0, 1);
  },
  get: () => {
    return "Hi";
  },
};
```

Use Typescript in NodeJS project

Setup

- `npm i -g pnpm` *(Alternative package manager)*
- `npm init es6` *(What?)*
- `pnpm install -D typescript tsx @types/node`
- Create `./src` directory

- Create `./src/index.ts`

```
function sayHello(name: string) {
  console.log("Hello " + name);
}

sayHello("World");
```

Compile

- `npx tsc src/index.ts --outDir dist`

Run (node)

- `node ./dist/index.js`

Run (tsx)

- `npx tsx ./src/index.ts`

Use TS configuration file

- `npx tsc --init`
- Modify `tsconfig.json`

```
{
  "compilerOptions": {
    "target": "es2022",
    "module": "nodenext",
    "outDir": "./dist"
  },
  "include": ["./src/**/*"]
}
```

Use TS configuration file (cont)

- Now just type `npx tsc`
- Use `npx tsc --showConfig` to see config.

Code - Async

```
async function getData() {
  const res = await fetch("https://jsonplaceholder.typicode.com/todos/1");
  return await res.json();
}

getData().then((data) => console.log(data));
```

Code - Import

`./src/lib.ts`

```ts
export const name = "Tom";
```

`./src/index.ts`

```ts
import { name } from "./lib.js";

sayHello(name);
```

Code - FS

```
import * as fs from "fs";
import { fileURLToPath } from "url";
import { dirname } from "path";
const __filename = fileURLToPath(import.meta.url);
const __dirname = dirname(__filename);

const dir = fs.readdirSync(__dirname);
console.log(dir);
```

- Fix `__dirname is not defined` error (Ref).

Using TSconfig template

- `@types/node @tsconfig/node-lts @tsconfig/node-ts` *(What)*

`./tsconfig.json`

```
{
  "extends": [
    "@tsconfig/node-lts/tsconfig.json",
    "@tsconfig/node-ts/tsconfig.json"
  ],
  "compilerOptions": {
    "outDir": "./dist"
  },
  "include": ["./src/**/*"]
}
```

TypeScript - NextJS

Installation

```
npx create-next-app@latest
```

```
fullstack-68 npx create-next-app@latest
Need to install the following packages:
create-next-app@15.3.4
Ok to proceed? (y) y

√ What is your project named? ... typescript-nextjs
√ Would you like to use TypeScript? ... No / Yes
√ Would you like to use ESLint? ... No / Yes
√ Would you like to use Tailwind CSS? ... No / Yes
√ Would you like your code inside a `src/` directory? ... No / Yes
√ Would you like to use App Router? (recommended) ... No / Yes
√ Would you like to use Turbopack for `next dev`? ... No / Yes
√ Would you like to customize the import alias (`@/*` by default)? ... No / Yes
Creating a new Next.js app in C:\Users\admin\Coding\fullstack-68\typescript-nextjs.
```

./tsconfig.json

```
{
  // ...
  "paths": {
    "@app/*": ["./src/app/*"],
    "@components/*": ["./src/components/*"]
  }
}
```

./src/app/globals.css

```
@import "tailwindcss";

// Remove everything else
```

./src/components/card.tsx

```tsx
import { FC } from "react";

interface Props {
  title: string;
  text?: string;
}

const Card: FC<Props> = ({ title, text }) => {
  return (
    <div className="border border-gray-300 p-2 rounded shadow-sm flex flex-col items-center">
      <div className="font-bold text-lg text-gray-800">{title}</div>
      <div className="text-gray-600">{text ?? "...."}</div>
    </div>
  );
};

export default Card;
```

./src/app/page.tsx

```tsx
import Card from "@components/Card";

export default function Home() {
  return (
    <div className="container flex m-2 gap-2">
      <Card title="Card 1" />
      <Card title="Card 2" text="Content Here" />
    </div>
  );
}
```