



TypeScript

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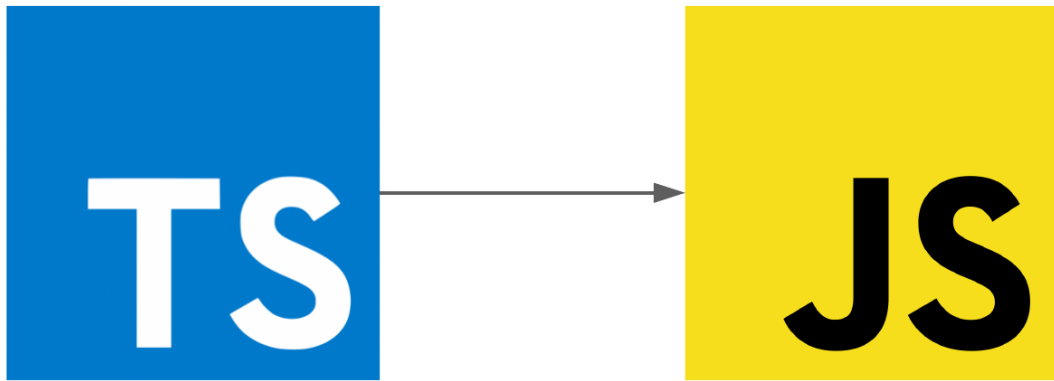
Introduction

What is TypeScript?

TypeScript is a JavaScript superset, which means that it is a language that builds up on JavaScript. It adds **new features and advantages** to JS.

Browsers and Node.js can't execute TypeScript.

TypeScript is more of a compiler that compiles code to JavaScript, it basically transforms your code into JS.



What does it add?

Most importantly, as the name suggests, it adds `types` to the JS language. This can be useful to prevent `runtime` errors.

Why TypeScript?

Let's assume this JS code:

```
function add(num1, num2) {  
  return num1 + num2;  
}  
  
add("1", "2");
```

We are passing strings to a function that should sum two numbers, this won't generate an error in JS but we will not receive the expected output (unwanted behavior at Runtime).

To fix this in JS we would need to do something like:

```
if (typeof num1 === "number" && typeof num2 === "number")
```

TypeScript can really help us in situations like this:

```
function add(num1: number, num2: number) {  
  return num1 + num2;  
}
```

With this extra syntax we openly state that we should only expect numbers.

Requirements

- Node.js
- TypeScript npm package

Install typescript

```
npm i -g typescript
```

Overview

TypeScript adds:

- Types
- Next-gen JS Features compiled down for older Browsers
- More features such as Interfaces or Generics
- Meta-Programming Features like Decorators
- Rich Configuration Options
- Modern tooling that helps even non TypeScript Projects (especially in IDEs).

Basics

Core Types

In TypeScript we have the following types (and more):

- number (all numbers)
- string
- boolean
 - no truthy or falsy values
- object
- array
- any
 - it is as flexible as writing normal JS
- undefined
- Function
- unknown
 - a value that is not guaranteed to be something.
- void
- never

Using types

```
function add (num1: number, num2: number) {  
    return num1 + num2;  
}  
  
const n1 = 10;  
const n2 = 3.2;  
  
const result = add(n1, n2);
```

TypeScript's type system only helps you during development.

Type Inference

TypeScript is smart enough to recognize some non-explicit variable types such as

```
let number1 = 5; // number1: number
```

We could do

```
let number1: number = 1;
```

We can also declare variables without values:

```
const n1: number;
```

Object types

Object properties in TS are stricter than in JS, if we have a `person` object:

```
const person = {  
    name: 'Leonardo',  
    age: 17  
};
```

We can't access `person.nickname`.

This is a 'generic' object, in TS we can be more specific:

```
const person: { name: string, age: number } = {  
    name: 'Leonardo',  
    age: 17  
};
```

In this case the object **must only have** a name property and an age property.

But this is not **best practice** since TS can pick it up on its own just by doing like in the example before this one.

Array types

TS describes an array with `type[]` where type can be `string`, `number` ...

So we can declare an array like this:

```
const arr: string[];
```

And we can only add strings.

If we want a `mixed` array we can use the `any` type.

More Types

TS has some new types.

Tuples

Fixed length and fixed content arrays.

```
const person: { name: string, age: number, role: [number, string] } = {  
  name: 'Leonardo',  
  age: 17,  
  role: [1, 'admin']  
};
```

NOTE: `push` is allowed in tuples even if, in this example, you can't manually create a 'role' tuple with more than 2 elements (or less than 2).

Enum

They assign labels to numbers and are useful for constant identifiers.

```
enum Role { ADMIN, READ_ONLY, AUTHOR };  
  
const person: {  
  name: string,  
  age: number,  
  role: Role.ADMIN  
} = {  
  name: 'Leonardo',  
  age: 17,  
  role: [1, 'admin']  
};
```

We can assign custom **values** (numbers...) to them if we want.

```
enum Role { ADMIN = 100, READ_ONLY = "abc", AUTHOR = 12 };
```

Union Types

We can specify more than a type to a variable with `union types`.

```
const someVariable: string | number;
```

Literal Types

Literal types are used to specify a precise value to assign to a variable. Especially useful for string identifiers or flags.

```
function doSomething(param1: number, param2: number, flag: 'do-this' | 'dont-do-this') {
  // code...
}
```

Here `flag` can only be:

- do-this
- dont-do-this

Type Aliases

We can create aliases for types:

```
type MyCustomType = number | string;
type AnotherType = ' :) ';
```

Function Return Types

We can specify a return type to returns:

```
function printResult (n1: number, n2: number): void {
  console.log('Result: ', + (n1+ n2));
}
```

We obviously don't need to specify it in this case.

Function as Types

Variables can hold a `function`.

```
const someVariable: Function;
```

We can even be more specific by doing:

```
// this is a function with NO arguments that returns a NUMBER
const temp = () => number;
```

This can also be useful to specify `callbacks`.

Unknown Type

Unknown is more restrictive than `any`.

For example we CAN'T do:

```
let a: unknown;
let b: string;

a = 5;
a = 'abc';

// NO
b = a;
```

This example would work in case of the `any` type.

Never Type

```
function generateError(message: string, code: number): never {
  throw { message: message, errorCode: code };
}

generateCode('Error Message', 500);
```

This function `never` returns a value. It is a special case (it crashes our program and stops there).

TS Compiler

To compile code we run `tsc file.ts`. But we can configure it with a `tsconfig.json`.

Command Options

<code>--watch</code>	Watch Mode to avoid compiling a file every time
<code>--init</code>	Init a project (compile multiple files and create tsconfig.json)

Flags in tsconfig

exclude	exclude files from compilation / node_modules
include	include files for compilation
files	points/specify files
target	ECMAScript target version
module	module system
lib	specify libraries (DOM)
checkJs	reports errors in .js files
sourcemap	bridge to connect the js files to the input ts files (we can see ts files in the source tab in the browser)
outDir	specify where the created js will be stored
rootDir	specify where to grab the ts files
noEmitOnError	don't emit js files if an error occurs

And many more.

Classes and Interfaces

Classes

```
class Department {  
  // attributes  
  name: string;  
  
  // constructor  
  constructor(n: string) {  
    this.name = n;  
  }  
  
  // methods  
  printName(this: Department) { // ts feature to specify that this method should run  
    // only on a Department object  
    console.log(this.name);  
  }  
}  
  
const dep = new Department('Dep Name');
```

Private Modifiers

```
class Department {  
  private name: string;  
  private employees: string[] = [];  
  
  constructor(n: string) {  
    this.name = n;  
  }  
  
  printName(this: Department) {  
    console.log(this.name);  
  }  
  
  addEmployee(employee: string) {  
    this.employees.push(employee);  
  }  
}
```

Properties are now accessible only in the class (not in **child** classes).

In order to share **private** properties to child classes thru **Inheritance** use the **protected** keyword.

Public Modifiers

Public is the default option so we don't need to set it.

```
class Department {  
  public name: string;  
  public employees: string[] = [];  
  
  constructor(n: string) {  
    this.name = n;  
  }  
  
  printName(this: Department) {  
    console.log(this.name);  
  }  
  
  addEmployee(employee: string) {  
    this.employees.push(employee);  
  }  
}
```

Shorthand Initialization

```
class Department {  
  // public name: string;  
  // public employees: string[] = [];  
  
  constructor(private name: string, public employees: string[]) {  
    // this.name = n;  
  }  
}
```

```

    }

    printName(this: Department) {
        console.log(this.name);
    }

    addEmployee(employee: string) {
        this.employees.push(employee);
    }
}

```

Read-only Modifier

```

class Department {
    private readonly name: string;
    private employees: string[] = [];

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

    printName(this: Department) {
        console.log(this.name);
    }

    addEmployee(employee: string) {
        this.employees.push(employee);
    }
}

```

We can't modify the name property.

Inheritance

```

class Department {
    private readonly name: string;
    private employees: string[] = [];

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

    printName(this: Department) {
        console.log(this.name);
    }

    addEmployee(employee: string) {
        this.employees.push(employee);
    }
}

class ITDepartment extends Department {
    constructor(id: string) {

```

```
        super('IT');
        this.id = id;
    }
}
```

We can also override parent methods in child classes by re-declaring them.

Getters and Setters

In order to access `private` attributes from the outside of a class we can implement `getters` and `setters`.

```
class Department {
    private name: string;

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

    get name(this: Department) {
        return this.name;
    }

    set name(value: string) {
        this.name = value;
    }
}

const d = new Department();

// Getter
console.log(d.name) // with no ()

// Setter
d.name = "Name";
```

We access them as `properties` and not methods.

Static Properties and Methods

Properties and Methods that we don't access from an instance. An example is `Math`.

```
class Department {
    private name: string;

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

    static createEmployee(name: string) {
        return { name: name };
    }
}
```

```
}

Department.createEmployee('Leo');
```

Abstract Classes

Back to Inheritance, we can force developers to implement a certain method in a class (especially child ones).

```
abstract class Department {
  private readonly name: string;
  private employees: string[] = [];

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

  printName(this: Department) {
    console.log(this.name);
  }

  addEmployee(employee: string) {
    this.employees.push(employee);
  }

  // we are just saying that every child must implement this method.
  abstract mandatoryMethod(this: Department): void;
}

class ITDepartment extends Department {
  constructor(id: string) {
    super('IT');
    this.id = id;
  }

  mandatoryMethod() {
    // code
  }
}
```

abstract classes **CAN'T BE INSTANTIATED**

Private Constructors

Singleton Pattern = have only one instance of a class.

With private constructors we can't use `new ClassName()` outside of the class.

```
class ITDepartment extends Department {
  // we need to provide an instance otherwise we can't create it with the 'new'
  keyword
  private static instance: ITDepartment;

  private constructor(id: string) {
```

```

        super('IT');
        this.id = id;
    }

    static getInstance() {
        if (ITDepartment.instance) {
            return this.instance;
        }

        this.instance = new ITDepartment();
    }
}

const it = ITDepartment.getInstance();
const it2 = ITDepartment.getInstance();

// it === it2

```

Interfaces

An interface describes the structure of an object (not the same thing as a custom type).

```

interface Person {
    name: string;
    age: number;

    printName(): void;
}

let user: Person;

user = {
    name: 'Leonardo',
    age: 17,
    printName: function () {
        console.log(this.name);
    }
}

```

We can also add `readonly` to properties.

Interfaces with Classes

We can implement an interface in a class.

```

interface Greetable {
    name: string;

    greet(): void;
}

class Person implements Greetable {
    name: string;
}

```

```

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

    greet() {
        console.log(this.name);
    }
}

let user: Greetable;

user = new Person('Leo');

```

The interface acts like a strict blueprint.

Inheritance with Interfaces

```

interface Named {
    readonly name: string
}

interface Greetable extends Named {
    greet(): void
}

interface AnotherInterface {
    readonly someValue: string
}

class Person implements Greetable, AnotherInterface {
    name: string;
    someValue: string;

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

    greet() {
        console.log(this.name);
    }
}

```

Interfaces as Function Types

```

interface AddFn {
    (a: number, b: number): number;
}

let add: AddFn;

add = (n1: number, n2: number) => {
    return n1 + n2;
}

```


Optional Parameters

```
interface Person {  
  name: string;  
  lastName?: string  
}
```

`lastName` will be optional

We can have optional parameters even in function and classes.

Advanced Types Concepts

Intersection Types

```
type Admin = {  
  name: string;  
  privileges: string[];  
};  
  
type Employee = {  
  name: string;  
  startDate: Date;  
};  
  
type ElevatedEmployee = Admin & Employee;
```

It's the same thing as `extending` interfaces.

```
type Type1 = string | number;  
type Type2 = number | boolean;  
  
type Intersection = Type1 & Type2; // --> number
```

Type Guards

```

type Combinable = string | number;

function add(a: Combinable, b: Combinable) {
  if (typeof a === 'string' || typeof b === 'string') { // this is a type guard
    return a.toString() + b.toString();
  }

  return a + b;
}

```

In case of combined types:

```

type Admin = {
  name: string;
  privileges: string[];
};

type Employee = {
  name: string;
  startDate: Date;
};

type UnknownEmp = Admin | Employee; // admin OR employee

function printEmpInfo(emp: UnknownEmp) {
  console.log(emp.name);
  if ('privileges' in emp) { // type guard
    console.log(emp.privileges);
  }
}

```

Or we could use `instanceof` as a type guard.

Discriminated Unions

```

interface Bird {
  type: 'bird'; // literal type
  flyingSpeed: number;
}

interface Horse {
  type: 'horse';
  runningSpeed: number;
}

type Animal = Bird | Horse;

function moveAnimal(animal: Animal) {
  let speed;
  switch (animal.type) {
    case 'bird':
      speed = animal.flyingSpeed;
    case 'horse':
      speed = animal.runningSpeed;
  }
}

```

```
}

    console.log("Moving at speed: ", speed);
}
```

Type Casting

We basically specify the type of something, useful especially when manipulating the DOM:

```
const inputEl = <HTMLInputElement>document.getElementById('user-input')!; // ! means
that we tell TS not to worry about the fact that maybe inputEl doesn't exist.

inputEl.value = "Hi there!"; // we can safely access value because we are telling TS
that inputEl is going to be HTMLInputElement, otherwise it complains about the fact
that the value property may not exist.
```

But this uses the same syntax as some React stuff (I don't know React I use Vue xD) so in that case we use the `as` keyword:

```
const inputEl = document.getElementById('user-input')! as HTMLInputElement;
```

Index Properties

We use them to build flexible interfaces.

```
interface ErrorContainer { // flexible container
    [prop: string]: string; // every property we add must be a string, it is like a
    'general keyword'
    id: string; // OK
    code: number; // NO
}
```

We specify that properties names and their values must be strings BUT we don't actually know the properties.

Function Overloads

```

type Combinable = string | number;

function add(a: number, b: number): number; // if both params are number then return a number
function add(a: Combinable, b: Combinable) {
  if (typeof a === 'string' || typeof b === 'string') { // this is a type guard
    return a.toString() + b.toString();
  }

  return a + b;
}

```

It is similar to an if statement but related to function params. It gets 'translated' to: if we call the function 'add' with two numbers then expect back a number. So later in the code we can handle the result as a number (we can use numbers related methods without warnings).

Optional Chaining

Useful when we fetch data from an API and we don't know if the result has some properties.

```

const fetchedData = {
  id: 'u1',
  name: 'Leo',
  // job: {title: 'CEO', paycheck: 10000} ---> imagine that this doesn't get fetched correctly
};

console.log(fetchedData.job.title) // ERROR

```

We can solve this by adding a `?` to the object

```

console.log(fetchedData.job?.title) // ERROR

```

Nullish Coalescing

If we don't know if a piece of data is `null` we can do:

```

const gotData = null; // data that we don't know if it is NULL

const storedData = gotData || 'Default'; // JS
const storedData = gotData ?? 'Default'; // TS --> ONLY IF gotData is null or undefined

```

Generics

They don't exist in JavaScript but the concept of Generic Types exist in other programming languages.

An array is actually a `generic` .

What are generics?

`Array<Type>`

A generic type is a type which is kinda connected with some other types and is really flexible in terms of what type the other type is.

The `Array` type doesn't really care about what data you store in it.

```
const names: Array<string> = []; // same thing as string[]
```

Another generic type is `Promise` .

```
const promise = new Promise((resolve, reject) => {  
  setTimeout(() => {  
    resolve('Done');  
  }, 1000)  
});
```

Here the type of the promise is `Promise<unknown>` because it will eventually resolve into something.

So we can say:

```
const promise: Promise<string> = new Promise((resolve, reject) => {  
  setTimeout(() => {  
    resolve('Done');  
  }, 1000)  
});
```

We specify that the promise eventually resolves into a `string` .

Generic types gives us more safety.

Custom Generic

Functions

```
function merge(objA: object, objB: object) {  
  return Object.assign(objA, objB);  
}  
  
const merged = merge({name: 'Leo'}, {age: 17});  
merged.age; // TS ERROR, typescript doesn't know the properties (we could do TYPE  
CASTING or GENERIC TYPES)
```

```
function merge<T, U>(objA: T, objB: U) { //T and U are cusotm identifiers
    return Object.assign(objA, objB);
}

// THIS FUNCTION RETURNS THE INTERSECTION OF T AND U
const merged = merge({name: 'Leo'}, {age: 17}); // name: string & age: number
```

They are used to specify that what we store in the result is the intersection between the parameters (we actually don't know what they are 'made of').

We can also specify what parameters we are passing:

```
const merged = merge<{name: string}, {age: number}>({name: 'Leo'}, {age: 17});
```

But this is redundant.

Constraints

Sometimes we want to **restrict** the types of generic types.

```
function merge<T extends object, U extends object>(objA: T, objB: U) { //T and U are
    cusotm identifiers
    return Object.assign(objA, objB);
}
```

So we have improved the merge function by reducing unwanted behaviors such as passing just a number to the `merge` function.

We can also improve this by creating custom `interfaces` and using them with `extends ...` if we only care about certain params properties.

KeyOf Constraint

```
function extractAndConvert(obj: object, key: string) {
    return obj[key]; // TS ERROR since we don't know if the object has the key
    property
}
```

We can fix this by using `generics`

```
function extractAndConvert<T extends object, U extends keyof T>(obj: T, key: U) {
    return obj[key]; // OK
}
```

Generic Classes

```
class DataStorage<T extends number | string | boolean> {
    private data: T[] = [];

    addItem(item: T) {
        this.data.push(item);
    }
}
```

```

    }

    removeItem(item: T) {
        if (this.data.indexOf(item) !== -1) this.data.splice(this.data.indexOf(item),
1);
    }

    getItems() {
        return [...this.data];
    }
}

const textStorage = new DataStorage<string>();
const numberStorage = new DataStorage<number>();

```

Generic Utility Types

Special Utility Types.

Partial

```

interface Article {
    title: string;
    description: string;
}

function createArticle(title: string, description: string): Article {
    const toServe: Partial<Article> = {}; // This is an object that in the **end**
will be an Article

    // building manually, maybe we have to do some filtering
    toServe.title = title;
    toServe.decription = description;

    return toServe as Article;
}

```

Readonly

```

const names: Readonly<string[]> = ['Leo', 'Anna'];

```

Generic vs Union Types?

```

class DataStorage<T extends number | string | boolean> {
    private data: T[] = [];

    addItem(item: T) {

```

```

        this.data.push(item);
    }

    removeItem(item: T) {
        if (this.data.indexOf(item) !== -1) this.data.splice(this.data.indexOf(item),
1);
    }

    getItems() {
        return [...this.data];
    }
}

```

```

class DataStorage {
    private data: (string | number | boolean)[] = [];

    addItem(item: string | number | boolean) {
        this.data.push(item);
    }

    removeItem(item: string | number | boolean) {
        if (this.data.indexOf(item) !== -1) this.data.splice(this.data.indexOf(item),
1);
    }

    getItems() {
        return [...this.data];
    }
}

```

In the second example we allow **mixed** types, to fix that we would have to do `string[] | number[] | boolean[]` BUT then we would have a problem while adding and removing stuff because with union types we allow some types every time we call that specific action.

So generic types makes us choose a type of data every time from a range of types, it doesn't accept mixed stuff.

In order words generics locks in a specific type.

Decorators

DISCLAIMER

Decorators are much more in depth than how they are described in this chapter so more knowledge [here](#).

Writing code that's easier to use for developers.

Decorators are usually about classes and they are **functions**.

MUST USE WITH ES6 AND EXPERIMENTAL-DECORATORS in TSConfig.JSON


```
function Logger(constructor: Function) { // decorators expect arguments
  console.log("Logging");
  console.log(constructor);
}

@Logger
class Person {
  name: 'Leo';

  constructor() {
    console.log("Creating person...");
  }
}
```

They run without an instance, so they execute when you define a class.

Decorators Factories

They create decorators that we can configure.

```
function Logger(logString: string) {
  return function(constructor: Function) {
    console.log(logString);
    console.log(constructor);
  }
}

@Logger('LOGGING-PERSON')
class Person {
  name: 'Leo';

  constructor() {
    console.log("Creating person...");
  }
}
```

Example

```
function WithTemplate(template: string, hookId: string) {
  return function(_: Function) { // we could pass a class constructor
    const hookEl = document.getElementById(hookId);
    if (hookEl) {
      hookEl.innerHTML = template;
    }
  }
}

@WithTemplate('<h1>Lorem Ipsum</h1>', 'app'); // app is an ID on a DIV
```

This is like an Angular Decorator.

We can also have multiple decorators per class and they execute from the bottom to the top.

Property Decorators

```
function Log(target: any, propertyName: string | Symbol) {
  console.log(target, propertyName);
}

class Product {
  @Log
  title: string;

  constructor(t: string) {
    this.title = t;
  }
}
```

We can also create decorators for methods and accessors.

Returning in a decorator

When can also return stuff in decorators, especially we can return classes.

NOTE: this will decorate a class with a `name` property

```
function WithTemplate(template: string, hookId: string) {
  return function<T extends {new(...args: any[]): {name: string}}>
    (original_constructor: T) {
      return class extends original_constructor { // based on the og constructor
        // adding new functionalities to the decorated class, this runs when the
        class is instantiated
        constructor(..._: any[]) {
          super();
          const hookEl = document.getElementById(hookId);
          if (hookEl) {
            hookEl.innerHTML = this.name;
          }
        }
      }
    }
}
```

This basically replace the class that it decorated by keeping its original values.

We can also return in method decorators.

Modules

Namespaces and File Bundling

Use "namespace" code syntax to group code. Bundled compilation is possible.

In a specific file (`fileName.ts`)

```
namespace AModule {  
    // code here  
    export interface numberOne {}  
    export interface numberTwo {}  
}
```

And we import it as follows:

```
/// <reference path="fileName.ts" />
```

But we can't access the single interfaces without putting the "main code" into a namespace with the same name as the exported one.

Result

We get back multiple files but **they aren't linked between each other**. In order to link them we have to set the `outFile` option in `tsconfig` which bundles everything in one file and we also need to set the `module` option to `amd`.

ES6 Modules

Modern JavaScript uses ES6 Imports/Exports. TypeScript also supports this. Bundling via third-party tools is possible.

Syntax

```
import defModule from './path/file.js'  
import { module } from './path/another.js'
```

As long as we don't use a `webpack` make sure to add `.js` even if we are developing in TypeScript or just omit the extension (this can cause some errors depending on you environment).

We can obviously use `default` exports and other features.

tsconfig

We need to set these flags in the `tsconfig.json`

```
target: es6 (or higher)
module: es2015 (or higher)
```

We can't use the `outfile` flag.

IMPORTANT

In a HTML file we have to add the `module` flag.

```
<script type="module" src="index.js"></script>
```

Modules get executed the first time they get imported in the app even though we import a single one multiple times in different files.

Webpack

What is Webpack?

Splitting code in multiple modules result in a lot of `http requests`.

Webpack is a tool to bundle files together (Build Orchestration Tool).

It also optimizes our code (minimized code, less imports, etc).

Install

```
npm install --save-dev webpack webpack-cli webpack-dev-server typescript ts-loader
```

Installing a copy of `typescript` in every project is a good practice in order not to break an existing project if typescript gets updated with deep new features.

Configurations

In `tsconfig.json`

```
target: es5/es6/esnext
module: es2015/es6
NO rootDir
sourceMap: true --> helps debugging
```

`webpack.config.js`

```
const path = require('path');

module.exports = {
```

```

entry: './src/apps.ts', // root project entry
output: {
  filename: 'bundle.js' // out file
  path: path.resolve(__dirname, 'dist') // absolute path (same as the one in
tsconfig)
},
devtool: 'inline-source-map', // already generated source maps (tsconfig)
// instructions on how to deal with ts files
module: {
  rules: [
    {
      test: /\.ts$/,
      use: 'ts-loader',
      exclude: /node_modules/
    }
  ]
},

resolve: {
  extensions: ['.ts', '.js']
}
};

```

REMOVE ALL EXTENSIONS IN IMPORT STATEMENTS

How to use Webpack

in `package.json`

```
"build" : "webpack"
```

And then we can use the generated file.

Dev Workflow

in `package.json`

```
"dev" : "webpack-dev-server"
```

In dev mode the bundle is generated in memory only

So we need to add (in `webpack.config.js`):

```

mode: 'development' // fewer optimizations
publicPath: 'dist'

```

Production Workflow

Useful Requirements

```
npm i --save-dev clean-webpack-plugin
```

To clear the bundle every time we have a new version.

`webpack.config.prod.js`

```
const path = require('path');
const CleanPlugin = require('clean-webpack-plugin');

module.exports = {
  mode: 'production',
  entry: './src/apps.ts', // root project entry
  output: {
    filename: 'bundle.js' // out file
    path: path.resolve(__dirname, 'dist') // absolute path (same as the one in
    tsconfig)
  },
  devtool: 'none', // already generated source maps (tsconfig)
  // instructions on how to deal with ts files
  module: {
    rules: [
      {
        test: /\.ts$/,
        use: 'ts-loader',
        exclude: /node_modules/
      }
    ]
  },
  resolve: {
    extensions: ['.ts', '.js']
  },
  plugins: [
    new CleanPlugin.CleanWebpackPlugin()
  ]
};
```

`package.json`

```
"build" : "webpack --config webpack.config.prod.js"
```

NodeJS and Express

Node is not able to run `TypeScript` files. We could install `ts-node` but it is not good for production.

What we can do is:

- `npm init`
- `tsc --init`
- `target: esnext`
- `moduleResolution: node`

- `npm i express`
- `npm i --save-dev nodemon`
- `npm i --save-dev @types/node`
- `npm i --save-dev @types/express`

Useful stuff

```
import { RequestHandler } from 'express';

export const controller: RequestHandler = (req, res, next) => {}
```

```
import { Request, Response, NextFunction } from 'express';
```

Credits

Extended cheatsheet made by Leonardo Folgon and made by following various resources on the internet.