TypeScript

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Content

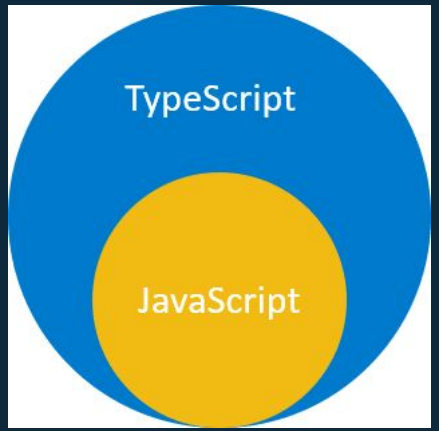
Before we get started

We make usage of some lingo:

- Extend === Inherit
- TS === TypeScript
- JS === JavaScript

1- What is TypeScript

- TypeScript is a super set of JavaScript.
- Adds additional syntaxes for supporting Types.
- Compiles from TS to JS



2- How to get started?

- You will need only a few things:
  - Node.js.
  - TypeScript Compiler.
  - Text Editor.

Installing TypeScript

You will have to enter these commands in the terminal:

1. $npm install -g typescript
2. $tsc --v (to check the version installed)
3. $npm install -g ts-node

In Windows is possible to get an error implying it does not recognise ‘tsc’.

To solve the error, add C:\Users\<user>\AppData\Roaming\npm to the PATH variable.

3- Basic usage

After installation you are ready to code:

1. Write your TS file
2. Run $tsc app.ts where app.ts is your file
3. If everything is correct then it should appear a .js file with the same name
4. Run $node app.js

You can run it directly running $ts-node app.ts

4- Types

Types are half the story about TS. It lets the programmer specify what type a variable is, and avoids mistakes thanks to a handy compiler.

The friend for hard-typed languages fans.

Types overview

```
1   let a: number = 1;
2   let b: string = "A";
3   let c: boolean = true;
4   let d: number[] = [1, 2];                          // array
5   let e: [number, string] = [1, "A"];                // tuple
6   let f: (number | string) = 1; // or "A"            // union
7   let g: any = "A";  // or 1, [1, 2], ...           // any
8   let h: void = undefined; // or null                // void
9   let i: never; // nothing can be assigned           // never
10
11  let j: {x: number, y: string} = {x:1, y:"A"};      // object
12
13  function hello(name: string): void {               // function
14      console.log(`Hello, ${name}!`);
15  }
16  let k: (x: string) => void = hello;                // function object
```

Types of types

- Primitive
  - number
  - string
  - boolean
- Objects
  - Everything else

Type inference

TS can inference the type of most things for you.

Type inference	Type annotation
TS guesses the type	You specify the type

For the most part, let TS guess. Only specify:

- If you want better readability.
- If TS can’t infer the type itself.
- Declare a variable for later use.

Objects and Tuples

Objects work as expected in TS as a type, but the compiler also checks when you access a property if the object has it.

Tuples are arrays where:

- The length can’t be altered.
- The type of the elements within is known.
- The order matters

Enum

Very much alike Python's enumerations. It's a set of values that are related in some way.

They go well with constants.

Any

Any represents a type that can be any type.
Simple.

Void & Never

Void denotes the *absence* of any type.

It's often used to mark that a function returns nothing.

Never is used to mark that you can't assign to anything.

It's used to mark functions that throw errors, or loop indefinitely.

Type joining & Aliases

You can join two types into one using the | operator.

You can make an alias of an existing type (renaming it).

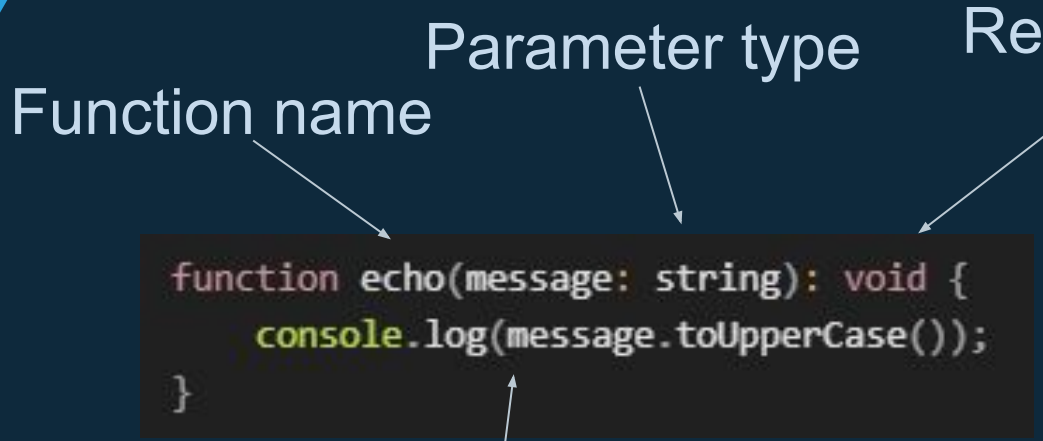
```
let result: number | string;
result = 10; // OK
result = 'Works'; // OK
result = false; // One way ticket to compiling error
```

String literals

Instead of a type, forces a variable to only accept assignment of the string literal specified. It's very handy when paired with **type union**.

```
let mouseEvent: 'click' | 'dblclick' | 'mouseup' | 'mousedown';
mouseEvent = 'click'; // valid
mouseEvent = 'not a click'; // not valid
let anotherEvent: mouseEvent; // reusable!
```

Anatomy of a function



Optional parameters

Optional parameters can be specified in TS.

To do so, add a ? postfix to the parameter name.

Rest parameters

“…” parameters should be noted as an array (use [])

5- Classes

Similar to JS with some interesting things:

- Access modifiers
- Readonly
- Getters and Setters

Access Modifiers

A class can restrict the access to some of their elements using three tags:

- private
- protected
- public (default if not specified)

They can be specified at declaration or in the class' constructor, even though it's not recommended whatsoever.

Access modifiers example

```
class Person {
  private ssn: string;
  private firstName: string;
  private lastName: string;

  // ...
}
```

ReadOnly

A class can specify if a variable will be immutable. It's similar to **const**, and it only can only be initialized in:

- The constructor
- The own declaration

It is recommended to **only** use it in classes attributes

Getter and Setter

Use them! The whole Internet (And Google) tell us to use them with purpose.

Google Style Guidelines says to use them with a **purpose**, not letting them be just a pass-through.

Inheritance, static, abstract

They all work the same as JS.

6- Interfaces

Interfaces are some sort of specific-use objects in the class sense.

Basically, it provides with a set of attributes and it can be used *as if it were a new type*.

They’re really cool, I swear

But what IS an interface??

Basically, a fancier dictionary.

It helps code be cleaner and set a common ground for classes and functions.

An example shall make this more understandable.

Function interfaces

We can also use an interface to show *how a function looks like*. What parameters it uses and what type is returns:

```
interface StringFormat {
    (str: string, isUpper: boolean): string
}

let format: StringFormat; // here!

format = function (str: string, isUpper: boolean) {
    return isUpper ? str.toLocaleUpperCase() : str.toLocaleLowerCase();
};

console.log(format('hi', true)); // HI
```

Interfaces for classes

A class can *implement* an interface. Similarly to C# and Java, it forms a contract of use among unrelated classes.

It tells classes how to use a set of functions, for example.

Or what parameters they should take into account.

Don’t worry an example later on will enlighten you.

Extending interfaces

Interfaces can extend from other interfaces as objects would do.

```
interface Mailable {
    send(email: string): boolean
    queue(email: string): boolean
}

interface FutureMailable extends Mailable {
    later(email: string, after: number): boolean
}
```

Interfaces extending classes

An interface can extend a **class**. However it won't inherit the class' methods or anything, as one would expect from class inheriting.

When an interface extends a class, it makes said interface **only usable by said class and their children**.

7- Extra Things

We'll go through several things to bear in mind:

- Type intersection
- Guards
- Type casting
- Type Assertion
- Generics
- Modules

Type Intersection

When you intersect type A with type B, the result will have both types' properties (all of them).

More interestingly, it also works with interfaces.

Meaning you can build bigger interfaces using smaller ones.

Guards

Guards are very extensive, and we can’t cover them completely.

They can be especially handy to ensure a function returns a certain kind of type to ease conditionals for the compiler.

Type casting

As in most languages, you can cast types in TS.

You may do so using the *as* keyword, or <>.

We recommend the first one, as it makes the code more readable, and the angles are not compatible with some libraries.

Type assertion

When a function may return a type sometimes or other(s) other times, you can tell the compiler which one you expect.

Use the *as* keyword as before, at the end of the function call.

It also improves readability of your code!

Generics (a.k.a templates)

Generics are TS' templates, which ease making generic algorithms for various data types.

One may benefit from using generics:

- Checks types in compiling time
- Doesn't need type casting
- Allows implementation of algorithms easier

Generic is very flexible

- Functions ✓
- Classes ✓
- Interfaces ✓

Modules

They are used the same as JS' ES6.

import/export structure.

They work as expected with extensions as well.

You can also export types!

8- Conclusions

The same as JavaScript, but better. Fixes many errors, adds hard typing (that's where the *Type*Script is at), and provides fantastic tools to make some really solid code.

Finally, I don't have to check argument types on every single function.

References

- TS slides
- Complete Tutorial (we used this heavily)
- Exercism track
- Official Web
- Official TS programmers
- Differences between TS and JS