

ES6 & TypeScript



- Generators are functions that can be paused and resumed.
- A function declared as **function*** returns a **Generator** instance.
- Generators are subtypes of iterators that include additional **next** and **throw** functions.
- Generators provide **yield** keyword to pause a function.

Simple Generator

```
//In app.js
```

```
import 'babel-polyfill';
```

```
function* myGenerator() {  
  console.log("1st line");  
  yield(555);  
  console.log("2nd line");  
  yield("End");  
}  
  
export function testGenerators() {  
  let gen = myGenerator();  
  console.log(gen.next());  
  console.log(gen.next());  
}
```

Output:

1st line

Object {value: 555, done: false}

2nd line

Object {value: "End", done: false}

Generator for Fibonacci series

```
function* fibonacci() {
```

```
    let pre = 0;
```

```
    let cur = 1;
```

```
    for(;;){
```

```
        [pre, cur] = [cur, pre + cur];
```

```
        let reset = yield cur;
```

```
        if(reset) {
```

```
            pre = 0;
```

```
            cur = 1;
```

```
        }
```

```
    }
```

```
}
```

```
let seq = fibonacci();
```

```
console.log(seq.next().value); //call multiple times
```

```
console.log(seq.next(true).value); //resets the Fibonacci series to one.
```

Output:

1

2

3

5

1

2

3

➤ ES6 has given support for collections in JavaScript. Now we have two data structures:

1. Map &
2. Set

Map data structure allows us to create data with key-value pairs.

```
let map = new Map();  
map.set('foo', 123);  
map.set('bar', 222);  
console.log(map.get('foo'));  
console.log(map.has('foo'));  
console.log(map.delete('foo'));  
console.log(map.has('foo'));  
  
map.clear();  
  
console.log(map.size);
```

Iterating over a Map

➤ **Iterating over keys:**

```
for (let key of map.keys()) {  
    console.log(key);  
}
```

➤ **Iterating over values:**

```
for (let value of map.values()) {  
    console.log(value);  
}
```

➤ **Iterating over entries (key, value both)**

```
for (let entry of map.entries()) { console.log(entry[0], entry[1]); }  
for (let [key, value] of map.entries()) { console.log(key, value); }
```

Spreading a Map

```
let map = new Map([  
  [1, 'one'],  
  [2, 'two'],  
  [3, 'three']  
]);  
let arr = [...map.keys()]; //Map spreading  
console.log(arr);
```

Output: [1,2,3]

- WeakMap is a map that doesn't prevent its keys from being garbage-collected. That means that you can associate data with objects without worrying about memory leaks.
- WeakMap is a data structure whose keys must be objects.
- WeakMap has same API as Map.
- You should not perform following operations on WeakMap:
 - You should not iterate over contents i.e. keys, values or entries.
 - You should not clear WeakMap.

- Set data structure stores data with no duplicate value.

```
let set = new Set();  
set.add('red');  
console.log(set.has('red'));  
set.delete('red');  
console.log(set.has('red'));  
set.clear();  
console.log(set.size);
```

- Set can also be created as follows:

```
let set = new Set(['red', 'green', 'blue']);
```

- Converting set to an array:

```
let set = new Set(['red', 'green', 'blue']);  
let arr = [...set]; //Spread operator  
console.log(arr);
```

- WeakSet is a set that doesn't prevent its elements from being garbage-collected.
- WeakSet doesn't recommend for iteration, looping, or clearing.

- Promises provide a standard implementation of handling asynchronous programming in JavaScript without using callbacks.
- A promise represents a value that we can handle at some point in the future.
- A promise contract is immutable.

Working with Promises

```
var p2 = Promise.resolve("foo");  
p2.then((res) => console.log(res)); //Output: foo
```

```
var p = new Promise(function(resolve, reject) {  
  setTimeout(() => resolve(4), 2000);  
});
```

```
p.then((res) => {  
  res += 2;  
  console.log(res);  
}); //Output: 6
```

```
p.then((res) => console.log(res)); //Output: 4      Promises are immutable.
```

Rejecting a Promise

Any promise throwing an error is considered as rejecting a promise.

```
var p = new Promise(function(resolve, reject) {  
    setTimeout(() => reject("Timed out!"), 2000);  
});
```

```
p.then((res) => console.log(res),  
(err) => console.log(err)); //Output: Timed out!
```

Rejecting a Promise

Any promise throwing an error is considered as rejecting a promise.

```
var p = new Promise(function(resolve, reject) {  
    setTimeout(() => reject("Timed out!"), 2000);  
});  
p.then((res) => console.log(res),  
(err) => console.log(err)); //Output: Timed out!
```

Promise.catch() method:

```
var p = new Promise(function(resolve, reject) {  
    setTimeout(() => {throw new Error("Error encountered!");}, 2000);  
});  
p.then((res) => console.log("Response:", res))  
.catch((err) => console.log("Error:", err)); //Throwing an Error is the same as calling reject().
```

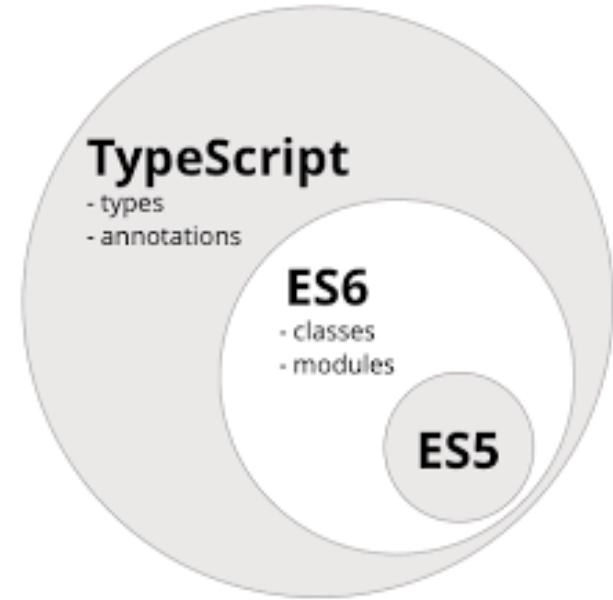
The `Promise.all()` method returns a single Promise that resolves when all of the promises in the iterable argument have resolved, or rejects.

```
var p = new Promise(function(resolve, reject) {  
    resolve("bar");  
});  
var p2 = new Promise(function(resolve, reject) {  
    setTimeout(() => resolve("foo"), 2000);  
});  
  
Promise.all([p, p2]).then(function (promises) {  
    promises.forEach(function (text) { console.log(text); }); //Output: bar foo after 2 secs.  
});
```


Sometimes we don't want to wait until all of the promises have completed; rather, we want to get the results of the first promise to fulfill.

```
function delay(ms) {  
    return new Promise((resolve, reject) => {  
        setTimeout(resolve, ms);  
    }); }  
  
Promise.race([ delay(3000).then(() => "I finished second."), delay(2000).then(() => "I finished  
first.") ])  
    .then(function(txt) {  
        console.log(txt);  
    })  
    .catch(function(err) { console.log("error:", err); });  
  
//Output: I finished first.
```

- TypeScript is a free and open-source programming language developed and maintained by Microsoft.
- It is a superset of JavaScript, and adds optional static typing and class-based object-oriented programming to the language.
- The major feature supported in TypeScript which is not available in ES6 is 'types' & 'annotations'.
- You can try TypeScript code online at <https://www.typescriptlang.org/play/>



Writing TypeScript App

- Create a new directory, for example 'typescript_demo'.
- Change directory: `cd typescript_demo`
- Install typescript using npm: `npm install -g typescript`
- Write a .ts file, may be greeter.ts.
- Compile greeter.ts using tsc compiler: `tsc greeter.ts`
- Now write index.html & include greeter.js file into it.
- Finally open index.html inside browser.

Built-in Types in TypeScript



- 1) Boolean
- 2) Number
- 3) String
- 4) Array
- 5) Tuple
- 6) Enum
- 7) Any
- 8) Void
- 9) Null
- 10) Undefined

Using Built-in data types

TypeScript supports variables having specific type. Thus, when you create a variable you may not only say 'var' or 'let' but you can specify its type like integer, string etc.

```
let isDone: boolean = false;
```

```
let decimal: number = 6;
```

```
let color: string = "blue";
```

```
let x: [string, number]; //tuple
```

```
x = ["hello", 10]; // OK
```

```
enum Color {Red, Green, Blue};
```

```
let c: Color = Color.Green;
```

Using Built-in data types

Any:

```
let notSure: any = 4;
```

```
notSure = "maybe a string instead";
```

```
notSure = false; // okay, definitely a Boolean
```

Void:

```
function warnUser(): void { alert("This is my warning message"); }
```

Null and Undefined:

```
let u: undefined = undefined;
```

```
let n: null = null;
```

Classes in TypeScript continue..



- TypeScript class contains fields, constructors & methods.
- You can have inheritance among classes using 'extends' keyword.
- However, TypeScript does not support multiple inheritance.

Classes in TypeScript



TypeScript class is similar to ES6 class, except we can specify the type of the fields the class is going to have.

```
class Car {  
    engine:string; //field  
    constructor(engine:string) {  
        this.engine = engine  
    }  
    disp():void {  
        console.log("Function displays Engine is : "+this.engine)  
    }  
}
```


An interface is a syntactical contract that an entity should conform to.

```
interface IPrintable {  
    max_elements: number;  
    print: ()=>void  
}  
  
let circle: IPrintable = {  
    max_elements: 100,  
    print:()=>console.log("Circle printed ", circle.max_elements)  
}  
circle.print();  
console.log("max elements = ", circle.max_elements);
```

Arrays with Interfaces



Interface can define both the kind of key an array uses and the type of entry it contains. Index can be of type string or type number.

```
interface namelist { [index:number]:string }
```

```
var list2:namelist = ["John",1,"Bran"] //Error. 1 is not type string
```

```
interface ages { [index:string]:number }
```

```
var agelist:ages;
```

```
agelist["John"] = 15 // Ok
```

```
agelist[2] = "nine" // Error
```

Multiple inheritance with Interfaces



```
interface IParent1 {
```

```
    v1:number
```

```
}
```

```
interface IParent2 {
```

```
    v2:number
```

```
}
```

```
interface Child extends IParent1, IParent2 { }
```

```
var lobj:Child = { v1:12, v2:23}
```

```
console.log("value 1: "+this.v1+" value 2: "+this.v2); //Output: value 1: 12 value 2: 23
```

Generics help us to create reusable components. It means, a component with generics are capable of working over variety of types rather than a single one.

Suppose there is a function that returns the same value as its argument:

```
function echo(arg: number): number { return arg; }
```

The 'echo' function will work only for number as input. If we want to use it for other types like string, array, boolean etc. then we should write argument type as 'Any'.

```
function echo(arg: any): any { return arg; }
```

However, function with 'any' will not really make it generic because we actually are losing the information about what that type was when the function returns.

Generics continue...

Let us write the 'echo()' function with generics support:

```
function echo<T>(arg: T): T {  
    return arg;  
}
```

```
let output = echo<string>("myString"); // type of output will be 'string'.
```

Thank You!

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