

ES6 & TypeScript



- ECMAScript is a specification for writing scripting language defined by European Computer Manufacturers Association (ECMA).
- Various scripting languages like JavaScript, ActionScript, Jscript etc. implement ECMAScript specifications. Thus, ECMAScript is a superset of JavaScript.
- ECMAScript's specification version 5 is called as ES5 & similarly specification version 6 is called as ES6 or ECMAScript 2015.

ECMAScript release history

Release	Year
ECMAScript 1	June 1997
ECMAScript 2	June 1998
ECMAScript 3	December 1999
ECMAScript 4	July 2008
ECMAScript 5	December 2009
ECMAScript 5.1	June 2011
ECMAScript 6	June 2015

- Added 'const' keyword to declare a constant & 'let' keyword to determine variable scope.
- Added several utility methods inside Math, Number, Array & String.
- Added 'arrow functions' similar to lambda expressions.
- Added 'extended parameter handling' similar to variable method arguments.
- Added module importing & exporting features.
- Added object oriented concepts so that we can write a class, we can have inheritance, static methods, getter/setter methods etc.
- Added collection classes like Map & Set along with iteration facility.

Setup Environment

Install Node.js (<https://nodejs.org/en/download/>)

Install 'Visual Studio Code' (<https://code.visualstudio.com/download>)

The background features a dark, textured surface with a repeating hexagonal pattern. Overlaid on this are vibrant, glowing green lines that flow and swirl across the frame, creating a sense of motion and energy. A bright green, glowing cross-like shape is visible on the right side, composed of several intersecting lines.

Developing first ES6 application

Steps to create ES6 application

1. `mkdir hello_app`

2. `cd hello_app`

3. Create `app.js`

```
document.write('Hello from ES6!!');
```

```
console.log('ES6 app loaded');
```

4. Create `index.html`

```
<html>
```

```
<body>
```

```
<script src="bundle.js"></script>
```

```
</body>
```

```
</html>
```

Steps to create ES6 application continue...



5. Create package.json file:

```
npm init
```

6. Add following dependencies into package.json

```
"devDependencies": {  
  "webpack": "1.14.0",  
  "babel-core": "6.21.0",  
  "babel-loader": "6.2.10",  
  "babel-preset-es2015": "6.18.0",  
  "webpack-dev-server": "1.16.2"  
}
```

7. Run '*npm install*'. It will install all dependencies required to run ES6 application.

Steps to create ES6 application continue...

8. Create webpack.config.js file. The webpack.config.js is a standard configuration file provided by webpack to put all of your configuration, loaders and other specific information relating to your build.

```
module.exports = {  
  entry: "./app.js",  
  output: { filename: "bundle.js" }  
}
```

entry - name of the top level file or set of files that we want to include in our build, can be a single file or an array of files. In our build, we only pass in our main file (app.js).

output - an object containing your output configuration. In our build, we only specify the filename key (bundle.js) for the name of the file we want Webpack to build.

Steps to create ES6 application continue...



9. Set the path for 'webpack' command.

```
set PATH=%PATH%;./node_modules/.bin
```

10. Run the command '*webpack*' on console. It will convert your ES6 code into ES5 in the form of bundle.js.

11. Start webpack-dev-server:

```
webpack-dev-server --inline
```

12. Find out on which port webpack-dev-server is running. Suppose it is 8080.

13. Finally, Run index.html inside browser:

```
http://localhost:8080/index.html
```

ES6 features

The background of the slide is a dark, textured surface with a repeating hexagonal pattern. Overlaid on this are several bright green, glowing, and semi-transparent wavy lines that flow from the right side towards the left. These lines have a dynamic, almost liquid appearance, with some areas being more intense and brighter than others, creating a sense of movement and energy.

ES6 allows to declare a constant whose value cannot be changed. For example:

```
const PI = 3.141593;
```

```
console.log(PI);
```

```
PI = 4.45; //Error
```

In JavaScript, any variable that is declared in the program is raised up to the top execution context. For example:

```
var submit = function() {  
    var x = "foo";  
    if (x == "foo") {  
        var y = "bar";  
    }  
    console.log(x);  
    console.log(y);  
}  
submit();
```

Output:

foo
bar

Scoping continue...

ES6 introduces 'let' keyword that respects the scope of a variable. For example:

```
var submit = function() {  
    var x = "foo";  
    if (x == "foo") {  
        let y = "bar";  
    }  
    console.log(x);  
    console.log(y);  
}  
submit();
```

Output:

foo

Uncaught ReferenceError: y is not defined

Creating object literals is made much easy in ES6 as compared to traditional JavaScript(ES5)

1. Computed Property Names:

ES6 provides support to create object literals where property name itself is a computed value.

```
var prop = "foo";  
  
var o = { [prop]: "hey", ["b" + "ar"]: "there", };  
  
console.log(o.foo);  
  
console.log(o.bar);
```

1. Method Properties:

A javascript object can have method as a value of any attribute & it is called as 'method properties'.

ES5 code:

```
let myMath = {  add: function(a, b) { return a + b; },    subtract: function(a, b) { return a -  
b; }  }
```

ES6 code:

```
let myMath = {  
  add(a, b) { return a + b; },  
  
  subtract(a, b) { return a - b; }  }
```

Object.assign()

The **object.assign()** method is used to copy property values from one or more source objects to a given target object. It will return the target object. Here is the syntax:

```
var copyObj = Object.assign(targetObj, sourceObj1, sourceObj2....)  
var obj = { firstname: "John", lastname: "Doe" };  
var copy = Object.assign({}, obj);  
console.log(copy); //Object {firstname: "John", lastname: "Doe"}
```

- Arrows are a function shorthand using the `=>` syntax.
- They are syntactically similar to the fat arrow syntax in C#, Java, and CoffeeScript.
- Arrow functions support both expression bodies and statement block bodies that return the value of the expression.
- Unlike functions, arrows share the same lexical `this` as their surrounding code.

Arrow Functions as expression body

Expression bodies are a single line expression with the `=>` token and an implied return value.

```
let nos = [2, 4, 6, 8, 10];
```

JavaScript (ES5) code:

```
Let square_nos = nos.map(function(num) { return num * num; });
```

ES6 code:

```
let square_nos = nos.map(num => num * num); //Arrow function  
console.log(square_nos); //[4, 16, 36, 64, 100]
```

Arrow Functions as statement body

Statement bodies are multiline statements that allow for more complex logic.

```
let fives = [];  
  
let nums = [1, 2, 5, 15, 25, 32];  
  
nums.forEach(v => {  
  
  if (v % 5 === 0)  
  
    fives.push(v);  
  
});  
  
console.log(fives); //[5, 15, 25]
```


Using 'this' inside arrow function

ES6 allows to access 'this' inside arrow functions.

```
let matt = {  
  name: "Matt",  
  friends: ["Tom", "Jerry", "Ivan"],  
  printFriends() {  
    this.friends.forEach(f =>  
      console.log(this.name + " knows " + f));  
  }  
}  
  
matt.printFriends();
```

Output:

Matt knows Tom

Matt knows Jerry

Matt knows Ivan

Extended parameter handling mechanism in ES6 provides us three major functionalities:

- Default parameter values and optional parameters
- Rest parameter
- Spread operator

Default parameter values and optional parameters



Default parameters allow your functions to have optional arguments.

```
let greet = (msg = 'hello', name = 'world') => {  
  console.log(msg,name);  
}  
greet();  
greet('hey');
```

Output:

hello world

hey world

Rest parameter

Rest parameter, indicated by three consecutive dot characters(...), allow your functions to have a variable number of arguments.

The rest parameter is an instance of Array, so all array methods work.

```
function f(x, ...y) {  
    console.log(y);  
    // y is an Array  
    return x * y.length;  
}  
console.log(f(3, 'hello', true) === 6);
```

Output:

`["hello", true]`

`true`

Spread operator

The spread operator is like the reverse of rest parameters. It allows you to expand an array into multiple formal parameters.

```
function add(a, b) {  
    return a + b;  
}  
  
let nums = [5, 4];  
console.log(add(...nums));
```

Output: 9

```
let a = [2, 3, 4];  
let b = [1, ...a, 5];  
console.log(b);
```

Output: [1, 2, 3, 4, 5]

➤ Template literals are indicated by enclosing strings in backtick characters (`)`)

➤ Template literals are used to construct single line or multi-line strings.

`In JavaScript '\n' is a line-feed.`

`Now I can do multi-lines

with template literals.`

➤ Template literals provide 'String interpolation' facility which can be used to compose very powerful strings in a clean.

```
var fname = 'Tom';
```

```
var salary = 10000
```

```
var incentive = 2000
```

```
let message = `My name is '${fname}' and I am having total salary ${salary + incentive}`;
```

```
console.log(message); //My name is 'Tom' & I am having total salary 12000
```


- The de-structuring assignment syntax is a JavaScript expression that makes it possible to extract data from arrays or objects.
- De-structuring can be applied at following places:
 - 1) Array matching
 - 2) Object matching
 - I. Shorthand notation
 - II. Deep matching
 - III. Parameter context
 - 3) Fail-soft de-structuring

Array Matching using de-structuring assignment



Array matching is used to pull the required values from an array into stand-alone variables.

```
let [a, , b] = [ 11, 24, 92 ]; //Array de-structuring  
console.log("a:", a, "b:", b);
```

Output:

a: 11 b: 92

Object Matching using de-structuring assignment



- Like array matching, object matching allows us to pull the required properties of an object into stand-alone variables.
- There are three ways to apply object matching-
 - I. Shorthand notation
 - II. Deep matching
 - III. Parameter context

Object Matching using Shorthand notation

Shorthand notation allows us to grab properties from an object & create new variables out of it.

```
let {id, title} = {id: 546, title: 'Fruit Delivery', price: 5200.85};
```

//Note, stand-alone variable name & object property name should match.

```
console.log("Id:", id, "Title:", title);
```

Output:

Id: 546 Title: Fruit Delivery

Object Deep Matching

Sometimes our object is more complex & contains nested properties. Data from such complex objects can be retrieved using deep matching.

```
let cust = {  
  name: "Microsoft Corp.",  
  address: {  
    street: "J. M. Road",  
    city: "Pune",  
    state: "Maharashtra",  
    zip: "411002"  
  }  
};  
let {address: {city, state}} = cust; //Deep matching  
console.log("City:", city, "State:", state);
```

Output:

City: Pune State: Maharashtra

Object matching using Parameter Context

Array matching & object matching can be applied towards function parameters.

```
function processArray([ name, val ]) {  
    console.log(name, val);  
}  
function processObject({ name: n, val: v }) {  
    console.log(n, v);  
}  
function processObject_2({ name, val }) {  
    console.log(name, val);  
}  
processArray([ "bar", 42 ]);  
processObject({ name: "foo", val: 7 });  
processObject_2({ name: "bar", val: 42 });
```

Output: bar 42 foo 7 bar 42

Fail soft de-structuring allows us to retrieve required values from array or object.

However, if value is not present then we can provide default value of a variable.

```
let list = [ 7, 42 ];
```

```
let [a = 1, b = 2, c = 3, d] = list; //Fail-soft de-structuring with default values.
```

```
console.log("a:", a, "\nb:", b, "\nc:", c, "\nd:", d);
```

Output:

a: 7

b: 42

c: 3

d: undefined

Modules provide support for exporting and importing values without polluting the global namespace.

Exporting a module (arith.js)

```
export function sum(x, y) {  
  return x + y;  
}  
export var pi = 3.141593;
```

Importing a module (app.js)

```
import {sum, pi} from './arith';  
console.log('2 pi = ' + sum(pi, pi));
```

Module export/import with alias

Export with alias:

//arith.js

```
function sum(x, y) {  
    return x + y;  
}  
  
let pi = 3.141593;  
export {sum as add, pi}
```

//app.js

```
import {add, pi} from './arith';  
console.log('2 pi = ' + add(pi, pi));
```

Import with alias:

//app.js

```
import {add as plus, pi} from './arith';  
console.log('2 pi = ' + plus(pi, pi));
```

Modules exporting single values are sometimes used in ES6. Such modules can be exported with default option. For example:

```
//arith.js
```

```
export default function sum(x, y) { return x + y; }
```

```
export function divide(x, y) {return x / y; }
```

```
//app.js
```

```
import sum from './arith'; //Note that default modules are imported without curly brackets.
```

```
import { divide } from './arith';
```

Module import with wildcard (*)

You can import all exported components into one line using wildcard (*). Suppose arith.js exports sum() & divide() functions then you can import them using wildcard as follows:

```
//app.js
```

```
import * as arithOpr from './arith';  
  
document.write('sum = ' + arithOpr.sum(20, 50));  
  
document.write('divide = ' + arithOpr.divide(20, 5));
```

ES6 provides support for writing classes.

```
class Animal {  
  constructor(name) {  
    this.name = name;  
  }  
  greeting(sound) {  
    return `A ${this.name} ${sound}`;  
  }  
  static echo(msg) {  
    console.log(msg);  
  }  
}  
  
let animal = new Animal("Dog");  
console.log(animal.greeting("barks")); //A Dog barks  
Animal.echo("roof, roof"); //root, roof
```

Class Inheritance

```
class Dog extends Animal {  
    constructor() {  
        super("Dog");  
    }  
    static echo() {  
        super.echo("bow wow"); //super can be used for static methods as well  
    }  
}
```

Class with getters & setters

```
export class Animal {  
    constructor(name) {  
        this.name = name;  
    }  
    get name() {  
        return this._name;  
    }  
    set name(value) {  
        this._name = value;  
    }  
}
```


Thank You!

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