

# TypeScript



# Agenda

- TypeScript Overview
- Types & Arrays, Functions
- ECMA Script 6+ Essentials
- Objects, Classes, Interfaces
- Generics, Modules, Decorators
- Consuming Services
- Bundling TS using Webpack

# TypeScript Overview

# What is TypeScript

- TypeScript is a typed superset of JavaScript that compiles to plain JavaScript
- Allows use of classes and other features in browsers that do not support ECMA Script 6
- Compiled by the TypeScript compiler from \*.ts to \*.js by „tsc.exe“
- Language spec on <http://www.typescriptlang.org/>
- Co-authored by Anders Hejlsberg – father of C#
- Current version 2.6

# Features

- Static Typing
- 100% ECMA Script 3 or 5 support
- Encapsulation using Revealing Module Pattern
- Support for constructors, properties, interfaces, enums
- Arrow Function support
- Can be combined with other JS Libs:
  - Angular
  - React
  - SharePoint Framework

# Playground

- Online editor at <http://typescriptlang.org> that helps understanding TS and see JS output

The screenshot displays the TypeScript Playground interface. At the top, the 'TypeScript' logo is on the left, and navigation links 'learn', 'play', 'download', and 'interact' are on the right. Below these are links for 'tutorial', 'handbook', 'samples', and 'language spec'. The interface is split into two main panels: 'TypeScript' on the left and 'JavaScript' on the right. The 'TypeScript' panel has a dropdown menu set to 'Walkthrough: Classes' and a 'Share' button. The 'JavaScript' panel has a 'Run' button. Both panels show code for a 'Greeter' class. The TypeScript code on the left uses class syntax, while the JavaScript code on the right uses function syntax to achieve the same functionality. The JavaScript code includes a 'Run' button to execute the code and view the output.

```
1 class Greeter {  
2   greeting: string;  
3   constructor(message: string) {  
4     this.greeting = message;  
5   }  
6   greet() {  
7     return "Hello, " + this.greeting;  
8   }  
9 }  
10  
11 var greeter = new Greeter("world");  
12  
13 var button = document.createElement('button');  
14 button.textContent = "Say Hello";  
15 button.onclick = function() {  
16   alert(greeter.greet());  
17 }  
18  
19 document.body.appendChild(button);  
20
```

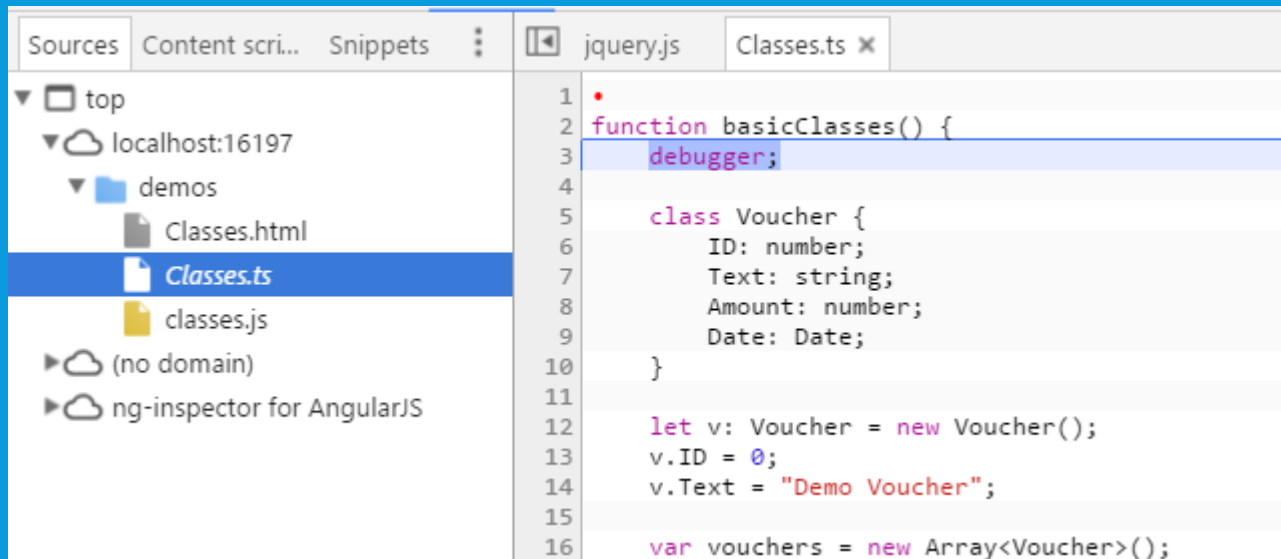
```
1 var Greeter = (function () {  
2   function Greeter(message) {  
3     this.greeting = message;  
4   }  
5   Greeter.prototype.greet = function () {  
6     return "Hello, " + this.greeting;  
7   };  
8   return Greeter;  
9 })();  
10 var greeter = new Greeter("world");  
11 var button = document.createElement('button');  
12 button.textContent = "Say Hello";  
13 button.onclick = function () {  
14   alert(greeter.greet());  
15 };  
16 document.body.appendChild(button);  
17
```

# Keywords & Operators

Keyword	Description
<b>class</b>	Container for members such as properties and functions
<b>constructor</b>	Provides initialization functionality in a class
<b>exports</b>	Export a member from a module
<b>extends</b>	Extend a class or interface
<b>implements</b>	Implement an interface
<b>imports</b>	Import a module
<b>interface</b>	Defines a code contract that can be implemented by types
<b>module</b>	Container for classes and other code
<b>public/private</b>	Member visibility modifiers
<b>...</b>	Rest parameter syntax
<b>=&gt;</b>	Arrow syntax used with definitions and functions
<b>&lt;typeName&gt;</b>	< > characters use to cast/convert between types
<b>:</b>	Separator between variable/parameter names and types

# \*.map files

- Map files are source map files that let tools map between the emitted JavaScript code and the TypeScript source files that created it
- Allows debugging \*.ts files instead of the \*.js files





# Transpiling

- Transpiling is the process of converting TypeScript code to the requires ECMA Script version
- Can be automated to happen "on Save"

```
class Voucher {  
    ID: number;  
    Text: string;  
    Amount: number;  
    Date: Date;  
}  
  
let v: Voucher = new Voucher();  
v.ID = 0;  
v.Text = "Demo Voucher";
```



```
var Voucher = (function () {  
    function Voucher() {  
    }  
    return Voucher;  
})();  
  
var v = new Voucher();  
v.ID = 0;  
v.Text = "Demo Voucher";
```

# The Command Line Interface

- Typescript compilation (transpilation) is done using tsc.exe
- Converts TypeScript file to JavaScript file: `tsc app.ts -> app.js`
- Options documented @ <https://www.typescriptlang.org/docs/handbook/compiler-options.html>
- Configuration of tsc can be automated using `tsconfig.json`


# tsconfig.json

- Documented at <https://www.typescriptlang.org/docs/handbook/tsconfig-json.html>
- tsconfig.json file indicates and configures a TypeScript project.
- Files to be compiled can be configured using:
  - "files"
  - "include"
  - "exclude"

```
{
  "compileOnSave": true,
  "exclude": [
    "node_modules"
  ],
  "compilerOptions": {
    "target": "es5",
    "sourceMap": true,
    "rootDir": "./wwwroot/",
    "strict": false,
    "moduleResolution": "node",
    "experimentalDecorators": true
  }
}
```


# VS Code Tools & Add-Ons

- CSharp2TS, JSON to TS-> Convert C# Classes (Data Models), JSON to Typescript
- TypeScript Hero ... Auto Import




### CSharp2TS

rafaelsalguero.csharp2ts

Rafael Salguero |  8,770 | ★★★★★ | License


Convert C# POCOs to typescript

[Install](#)




### JSON to TS

MariusAlchimavicius.json-to-ts

MariusAlchimavicius |  27,390 | ★★★★★


Convert JSON object to typescript interfaces

[Install](#)



### TSLint

eg2.tslint

egamma |  1,071,725 | ★★★★★ | License

TSLint for Visual Studio Code

[Reload](#) [Disable ▼](#) [Uninstall](#)

# TS Lint

- Linting ensures Code Quality in teams & helps detect potential errors
- `npm install -g tslint typescript.`
- Configured using `tslint.json` - Documentation @ <https://palantir.github.io/tslint/>















```
@Injectable()
export class Demo {
  private items: DemoItem [] = [
    {url: "inline", title: 'Inline Style'},
    {url: "stylebinding", title: 'Style Binding'}
  ]
}
```

[tslint] expected nospace before colon in property-declaration (typedef-whitespace)

```
"typedef-whitespace": [
  true,
  {
    "call-signature": "nospace",
    "index-signature": "nospace",
    "parameter": "nospace",
    "property-declaration": "space",
    "variable-declaration": "space"
  }
],
```

# ES 6 Shims

- Provides compatibility shims so that legacy JavaScript engines behave as closely as possible to ECMAScript 6
- A *shim* is a library that brings a new API to an older environment, using only the means of that environment
- Published @ <https://www.npmjs.com/package/es6-shim>

 Android	 Firefox	 Chrome	 IE	 iPhone	 Safari
4.4  * ✓	19  XP ✓	48  * ✓	9  7 ✕	7.1 ✕ 10.9 ✓	6 ✕ 10.8 ✓
	44 ✕ 10.10 ✓	49  XP ✓	10  8 ✕		7 ✕ 10.9
	45  * ✕	50 ✕ 10.9 ✓	11  8.1 ✓		8 ✕ 10.10 ✓

# Polyfill

- A polyfill is a piece of code (or plugin) that provides the technology that you, the developer, expect the browser to provide natively.
- Thus, a polyfill is a shim for a browser API
- You typically check if a browser supports an API and load a polyfill if it doesn't

# Types



# Types and Variables

- string
- number
- Boolean
- any
- Date
- object, complex type
- void
- Null, undefined

```
var age: number;  
var weight: number = 83.12;  
var dogWeight = 25.4;  
  
var isCustomer: boolean = false;  
var finished = false;  
  
var dogName: string = "Giro";  
var otherDogName = "Soi";  
var x = 10;
```

# Number, Strings & Booleans

- Boolean - The most basic datatype is the simple true/false value
- Number – Allows storage of all numeric types (decimal, hex, int, binary)
- String - Uses double quotes (") or single quotes (') to surround string data

```
var numbers: number[] = [];  
numbers[0] = 1;  
//numbers.push("two"); // compile-time error
```

# var | let | const

- Variables can be declared using "var" or "let" – the difference is scoping
- "let" is scoped to the nearest enclosing block or global if outside any block
- const declares constants – value cannot be changed

```
var index: number = 0;
var array = ["a", "b", "c"];
for (let index: number = 0; index < array.length; index++) {
  console.log("Inside for ..." + index);
  console.log("Inside for ..." + array[index]);
}
console.log(index); // 0
const pi = 3.14;
//pi = 2;
```

# String Functions

- Template Literals using Backticks `...` and `${VARIABLE}`
- `String.prototype.repeat` / `String.prototype.contains`
- `String.prototype.startsWith` / `String.prototype.endsWith`

```
//Template Literals
var productID = 100;
var category = "music";
var url = "http://server/" + category + "/" + productID;
var templateLiteral = `http://server/${category}/${productID}`;

//startsWith
var str = 'To be, or not to be, that is the question.';
console.log(str.startsWith('To be'));           // true
console.log(str.endsWith('question.'));         // true
```

# Enums

- Enums allow us to define a set of named numeric constants.
- An enum can be defined using the enum keyword.

```
enum VoucherStatus {draft, complete, pending};  
  
var n: VoucherStatus;  
n = VoucherStatus.draft;  
n = VoucherStatus.complete;  
//n = VoucherStatus.unfinished; // compile-time error  
//n = "on the way"; // compile-time error
```

# Any

- Any allows you to gradually opt-in and opt-out of type-checking during compilation
- -> Avoid using Any
- Remember if you need to convert C# types to types in TypeScript use Typescript Syntax Past or one of the many online services

```
let notSure: any = 4;  
notSure = "maybe a string instead";  
notSure = false; // okay, definitely a boolean
```

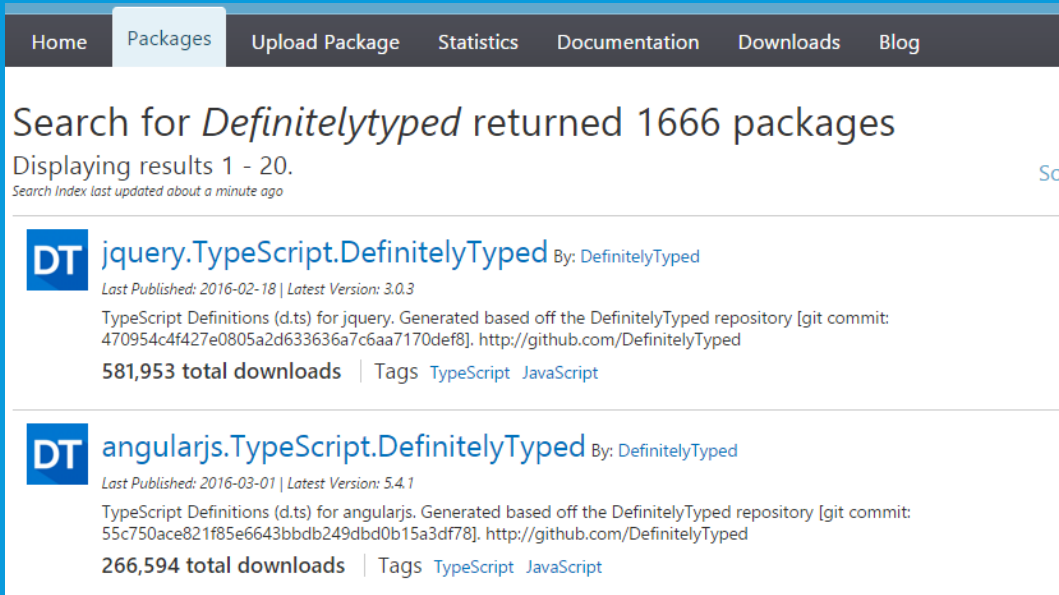
# Void

- Void is a little like the opposite of any – the absence of any type at all
- Usefull when used together with function
- No so usefull for variables -> can hold only null or undefined

```
function handleClick(): void {  
    var g = "I don't return anything.";  
    console.log(g);  
}
```

# Type Declarations

- Additional Types & IntelliSense for 3rd Party Libs using Type Definition Files like Definitely Typed published on <http://definitelytyped.org/>



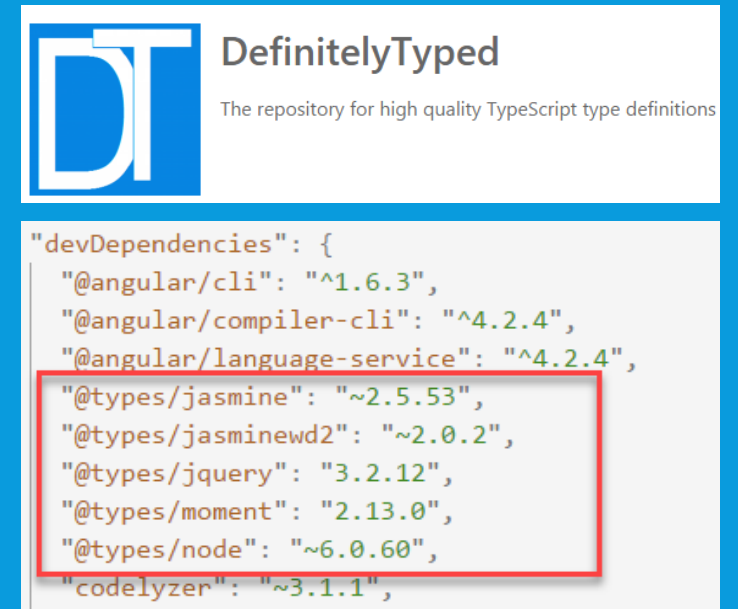
The screenshot shows the DefinitelyTyped website interface. At the top is a navigation bar with links: Home, Packages, Upload Package, Statistics, Documentation, Downloads, and Blog. Below the navigation bar, a search bar displays the results for 'jquery.TypeScript.DefinitelyTyped', indicating 1666 packages found. The first result is for 'jquery.TypeScript.DefinitelyTyped' by DefinitelyTyped, with a last published date of 2016-02-18 and a latest version of 3.0.3. It includes a description of the package and its total downloads (581,953). The second result is for 'angularjs.TypeScript.DefinitelyTyped' by DefinitelyTyped, with a last published date of 2016-03-01 and a latest version of 5.4.1. It also includes a description and total downloads (266,594).

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Search for *Definitelytyped* returned 1666 packages  
Displaying results 1 - 20.  
Search Index last updated about a minute ago

**DT** **jquery.TypeScript.DefinitelyTyped** By: DefinitelyTyped  
Last Published: 2016-02-18 | Latest Version: 3.0.3  
TypeScript Definitions (d.ts) for jquery. Generated based off the DefinitelyTyped repository [git commit: 470954c4f427e0805a2d633636a7c6aa7170def8]. <http://github.com/DefinitelyTyped>  
**581,953 total downloads** | Tags [TypeScript](#) [JavaScript](#)

**DT** **angularjs.TypeScript.DefinitelyTyped** By: DefinitelyTyped  
Last Published: 2016-03-01 | Latest Version: 5.4.1  
TypeScript Definitions (d.ts) for angularjs. Generated based off the DefinitelyTyped repository [git commit: 55c750ace821f85e6643bbdb249dbd0b15a3df78]. <http://github.com/DefinitelyTyped>  
**266,594 total downloads** | Tags [TypeScript](#) [JavaScript](#)



The screenshot shows the header of the DefinitelyTyped website, featuring the 'DT' logo and the text 'DefinitelyTyped' and 'The repository for high quality TypeScript type definitions'. Below the header, a code snippet is displayed, showing a 'devDependencies' object. A red box highlights the dependencies for '@types/jasmine', '@types/jasminewd2', '@types/jquery', '@types/moment', and '@types/node'.

**DT** **DefinitelyTyped**  
The repository for high quality TypeScript type definitions

```
"devDependencies": {  
  "@angular/cli": "^1.6.3",  
  "@angular/compiler-cli": "^4.2.4",  
  "@angular/language-service": "^4.2.4",  
  "@types/jasmine": "~2.5.53",  
  "@types/jasminewd2": "~2.0.2",  
  "@types/jquery": "3.2.12",  
  "@types/moment": "2.13.0",  
  "@types/node": "~6.0.60",  
  "codelyzer": "~3.1.1",  
}
```



# Using Typings

- Add import statements as needed

```
import * as moment from 'moment';  
import * as $ from 'jquery';
```

- Use your lib accordingly

```
//using moment  
let dt = new Date();  
console.log("Using time format: ", moment(dt).format('LTS'));  
  
//using jQuery  
let myArray = ["Angular", "React", "SPFx"];  
console.log("myArray is an Array: ", $.isArray(myArray));
```

# Arrays

# Arrays

- Arrays can be typed

```
//declaration using type followed by []  
var customers: string[] = ["Alex", "Giro", "Sonja", "Soi", "David"];  
//declaration using generic array type  
let nbrs: Array<number> = [3, 4, 5];
```

- ECMA Script 6 array functionality is supported
  - for ... of
  - destructuring
  - map
  - ....

```
let input = [1, 2];  
let [first, second] = input;
```

# For-of-loop

The for-of loop iterates over the values

- Of an array
- Of an iterable object

```
var someArray = ["a", "b", "c"];  
for (var item in someArray) {  
    console.log(item); // 0,1,2 ... Returns the key ... the index  
}  
  
for (var item of someArray) {  
    console.log(item); // a, b, c  
}
```

# Map

- The Map object is a simple key/value map.
- Any value (both objects and primitive values) may be used as either a key or a value.

```
var myMap = new Map();
var keyString = "a string",
    keyObj = {},
    keyFunc = function () { };
// setting the values
myMap.set(keyString, "value associated with 'a string'");
myMap.set(keyObj, "value associated with keyObj");
myMap.set(keyFunc(), "value associated with keyFunc");
console.log("Map size: " + myMap.size); // 3
// getting the values
myMap.get(keyString); // "value associated with 'a string'"
myMap.get("a string"); // "value associated with 'a string'" because keyString === 'a string'
myMap.get(keyObj); // "value associated with keyObj"
```

# Sets

- The Set object lets you store unique values of any type, whether primitive values or object references.
- Can iterate its elements in insertion order. A value in the Set may only occur once; it is unique in the Set's collection.

```
var mySet = new Set();
mySet.add(1);
mySet.add("some text");
var o = { a: 1, b: 2 };
mySet.add(o);

mySet.has(1); // true
mySet.has(3); // false, 3 has not been added to the set
mySet.has(Math.sqrt(25)); // true
mySet.has("Some Text".toLowerCase()); // true
mySet.has(o); // true
mySet.size; // 4
mySet.delete(5); // removes 5 from the set
```

# Destructuring

- Makes it possible to unpack values from arrays, or properties from objects, into distinct variables.

```
var rect = { x: 0, y: 10, width: 15, height: 20 };  
  
// Destructuring assignment  
var { x, y, width, height } = rect;  
console.log(x, y, width, height); // 0,10,15,20
```

# REST Parameter

- Represented using ...items
- Allows calling a function with a variable number of arguments without using the arguments object

```
store.add('fruit', 'apple');  
store.add('dairy', 'milk', 'cheese', 'yoghurt');  
store.add('pastries', 'donuts', 'croissants');  
  
store.add = function(category, ...items) {  
  items.forEach(function (item) {  
    store.aisle[category].push(item);  
  });  
};
```



# Spread Operator

- The spread operator allows an expression to be expanded in places where multiple arguments (for function calls) or multiple elements (for array literals) are expected

```
var a, b, c, d, e;  
a = [1, 2, 3];  
b = "dog";  
c = [42, "cat"];  
  
// Using the concat method.  
d = a.concat(b, c);  
// Using the spread operator.  
e = [...a, b, ...c];  
console.log(d);  
console.log(e);  
  
// Output:  
// 1, 2, 3, "dog", 42, "cat"  
// 1, 2, 3, "dog", 42, "cat"
```

# Functions

# Functions

- Typescript knows named and anonymous functions
- Parameters can be typed
- Optional, default parameters supported
- Lambda Expressions, Rest Parameters supported

```
function multiply(a, b = 1) {  
    return a*b;  
}  
  
multiply(5); // 5
```

```
var rectangleFunction = function (width: number, height: number) {  
    return width * height;  
}  
  
//Implemented as Lambda or "Arrow" Function  
var rectangleFunctionArrow = (width: number, height: number) => height * width;  
var result: number = rectangleFunctionArrow(10, 22);
```

# Arrow Functions

- Known als Lambda Functions in C#

```
numbers.sort(function(a, b){  
    return b - a;  
});
```

Becomes



```
numbers.sort((a, b) => b - a);
```

```
var fullnames = people.filter(p => p.age >= 18).map(p => p.fullname);
```

# Function Overloading

- TypeScript allows you to define overloaded functions
- Only one implementation
- Requires type checking during the implementation because of underlying JS

```
addCustomer(custId: number){};  
addCustomer(company: string);  
addCustomer(value: any) {  
    if (value && typeof value == "number") {  
        alert("First overload - " + value);  
    }  
    if (value && typeof value == "string") {  
        alert("Second overload - " + value);  
    }  
}
```

# Generator Functions

- Functions that can be called multiple times until they are executed to their final stage
- Each "yield"-statement defines one stop in execution
- Many times used together with for ... of to generate data

```
function* getColors() {  
    //Code to be executed in between  
    yield "green";  
    yield "red";  
    yield "blue";  
}  
  
const colorGenerator = getColors();  
  
debugger;  
console.log(colorGenerator.next());  
console.log(colorGenerator.next());  
console.log(colorGenerator.next());
```

# Objects

# Object Literals

- An object literal is a list of zero or more pairs of property names and associated values of an object, enclosed in curly braces {}
- Possible to add functions to Object Literals

```
let person: any = {Id: 1, Name: 'Alexander'}  
person.walk = () => console.log(`I am ${person.Name} and I'm walking`);
```



# Property / Method Shorthand

```
//Property value shorthand
function getCarES5(make, model, value) {
  return {
    make: make,
    model: model,
    value: value
  };
}
```

```
// with property value shorthand
// syntax, you can omit the property
// value if key matches variable
// name
function getCar(make, model, value) {
  return {
    make,
    model,
    value
  };
}
```

```
//Method definition shorthand
function getBusES5(make, model, value) {
  return {
    depreciate: function() {
      this.value -= 2500;
    }
  };
}
```

```
// Method definition shorthand syntax
// omits `function` keyword & colon
function getBus(make, model, value) {
  return {
    depreciate() {
      this.value -= 2500;
    }
  };
}
```

# Value / Reference Types

- Javascript is always pass by value, but when a variable refers to an object (including arrays), the "value" is a reference to the object.
- Changing the value of a variable never changes the underlying primitive or object, it just points the variable to a new primitive or object.
- However, changing a property of an object referenced by a variable does change the underlying object.

# Immutability

- In object-oriented programming, an immutable object is an object whose state cannot be modified after it is created.
- In JS string and numbers are immutable by design for other objects use Immutable.js
- The concept of Immutability is often used in larger applications when State Management is centralized using libraries like Redux (... which can be used to manage State in Angular Apps)
- Immutability eliminates the risk of having unwanted side effects by always creating „new“ copies of objects when changing the state

# object.assign()

- Is used to copy the values of all enumerable own properties from one or more source objects to a target object.
- Will return the target object
- Used when working with architectural patterns like Redux & immutability

```
var obj = { name: 'alex' };  
var copy = Object.assign({}, obj, {birth: moment("19700402", "YYYYMMDD").format("MMM Do YY")});  
console.log(copy);
```

# Cloning Objects using Spread Operator

- Spread Operator can be used to
  - create „new“ copies of objects or
  - combine a set of objects
- Needs no polyfill for older browsers (... compared to object.assign())

```
var simplePerson = { name: 'alex' };  
var dataPerson = {birth: moment("19700402", "YYYYMMDD").format("MMM Do YY"), job: 'dev dude'}  
  
var person = {...simplePerson, ...dataPerson};  
console.log(person);
```

# Classes, Interfaces

# Classes

Implemented as modules to avoid polluting global namespace with the following members

Support:

- Fields – referenced using "this." – e. g. this.greeting
- Properties
- Constructor
- Functions
- ....

```
class Greeter {  
    greeting: string;  
    constructor(message: string) {  
        this.greeting = message;  
    }  
    greet() {  
        return "Hello, " + this.greeting;  
    }  
}  
  
var greeter = new Greeter("world");
```

# Constructor

- Called when creating an instance of a class
- Can be overloaded – but only with one implementation
- Can define public and private properties
- Can define default values and nullable parameters

```
class Person {  
    name: string;  
    alive: boolean;  
    constructor(Name: string, Alive: boolean) {  
        this.name = Name;  
        this.alive = Alive;  
    }  
}
```



# get / set

```
let passcode = "secret passcode";

class Citzien {
  private _fullName: string;

  get fullName(): string {
    return this._fullName;
  }

  set fullName(newName: string) {
    if (passcode == "secret passcode") {
      this._fullName = newName;
      console.log("name changed to " + newName);
    }
    else {
      console.log("Error: Unauthorized update of employee!");
    }
  }
}
```

# Class Inheritance

- Class inheritance is achieved using the "extends" keyword
- Protected / Private / ReadOnly Properties are supported - Abstract classes are supported
- Properties of the base calls are accessed using "super"

```
class Sighthound extends Dog {  
    constructor(name: string) { super(name); }  
    public speed: string = "with up to 110 km/h";  
    move(meters = 500) {  
        console.log("Running ..." + meters + "m. " + this.speed);  
        super.move(meters);  
    }  
}
```

# Static Members (Properties)

- Classes in TypeScript can either contain
  - static members or
  - instance members.

```
class Grid {  
    static origin = { x: 0, y: 0 };  
    calculateDistanceFromOrigin(point: { x: number; y: number; }) {  
        var xDist = (point.x - Grid.origin.x);  
        var yDist = (point.y - Grid.origin.y);  
        return Math.sqrt(xDist * xDist + yDist * yDist) / this.scale;  
    }  
    constructor(public scale: number) { }  
}
```

# Interfaces

- In TypeScript, interfaces fill the role of defining contracts within your code as well as contracts with code outside of your project
- Support optional properties
- Can also be used to describe functions

```
interface SearchFunc {  
    (source: string, subString: string): boolean;  
}  
  
var mySearch: SearchFunc;  
mySearch = function (source: string, subString: string) {...}
```

# Nullability

- Interfaces support nullable properties

```
interface IManager {  
    name: string;  
    salary?: number;  
}  
  
class DeliveryManager implements IManager {  
    name: string;  
}
```

# Interfaces and Objects

- Interfaces are many times used to hold value objects
  - Data received from an WebApi or Angular service
  - Client should only know structure of data

```
interface ILongLat { Long: number, Lat: number };  
var position: ILongLat = { Long: 17.123123, Lat: 12.123123 };  
console.log("We are at position Long: " + position.Long + " Lat: " + position.Lat);
```

# Generics, Modules, Decorators

# Generic Functions

- Generics allow creating reusable components that can return any given type
- The type in the generic is passed using <T>

```
function concat<T>(arg: Array<T>): string {  
    let result = "";  
    for (var m of arg) {  
        result += m.toString() + ", ";  
    }  
    return result;  
}  
  
let stringArr: Array<string> = ["Alex", "Giro", "Soi the Whippet"];  
console.log(concat<string>(stringArr));  
  
let nbrArr: Array<number> = [100, 201, 322];  
console.log(concat<number>(nbrArr));
```



# Generic Interfaces

- Generic Interfaces define Interfaces for a give type specified using T

```
interface IInventory<T> {  
    getNewestItem: () => T;  
    addItem: (newItem: T) => void;  
    getAllItems: () => Array<T>;  
}  
  
let voucherInventory: IInventory<Vouchers.IVoucher>;
```

# Generic Classes

- Used to implement utility classes for a given type
- Can implement generic interfaces

```
class Catalog<T> implements IInventory<T> {  
    private items = new Array<T>();  
  
    addItem(newItem: T) { this.items.push(newItem);}  
  
    getNewestItem(): T { return this.items[this.items.length-1]; }  
  
    getAllItems(): T[] { return this.items; }  
}
```

# Generic Constraints

- Describe types that may be passed as a generic parameter
- The "extends"-keyword applies the constraint

```
interface ICatalogItem {  
    catalogNumber: number;  
}  
  
interface IInventory<T> {  
    getAllItems: () => Array<T>;  
}  
  
class Catalog<T extends ICatalogItem> implements IInventory<T> {  
    private items = new Array<T>();  
    getAllItems(): T[] { return this.items; }  
}
```

# Modules

- Organize other elements like classes and interfaces for better maintainability
- Are executed in their own scope – not the global scope
- Elements that should be visible outside must explicitly be exported / imported

```
export namespace MathFunctions {  
    export function square(nbr: number): number {  
        return Math.pow(nbr, 2);  
    }  
}
```



mathFunctions.ts

```
import mathFunctions = require("./mathFunctions");  
let sq = mathFunctions.MathFunctions.square(10);
```



otherFile.ts

# Namespaces

- Namespaces are declared using "namespace" keyword
- TypeScript allows multi-file namespaces
- Aliases simplify working with namespaces

```
export namespace MathFunctions {  
    export function square(nbr: number) : number {  
        return Math.pow(nbr, 2);  
    }  
}  
  
import mf = MathFunctions;  
let sq = mf.square(10);
```

# Decorators

- Decorators add descriptive information to classes
  - Annotations
  - Metadata
- Used by frameworks like
  - Angular
  - React

```
1 import {Component} from '@angular/core';
2
3 @Component({
4   selector: 'app',
5   templateUrl: './app.component.html',
6 })
7 export class AppComponent {
8 }
```

tsconfig.json

```
1 {
2   "compileOnSave": false,
3   "compilerOptions": {
4     "outDir": "./dist/out-tsc",
5     "baseUrl": "src",
6     "sourceMap": true,
7     "declaration": false,
8     "moduleResolution": "node",
9     "emitDecoratorMetadata": true,
10    "experimentalDecorators": true,
11    "target": "es5",
12    "typeRoots": [
13      "node_modules/@types"
14    ],
15    "lib": [
16      "es2016",
17      "dom"
18    ]
19  }
20 }
```

# Consuming Services

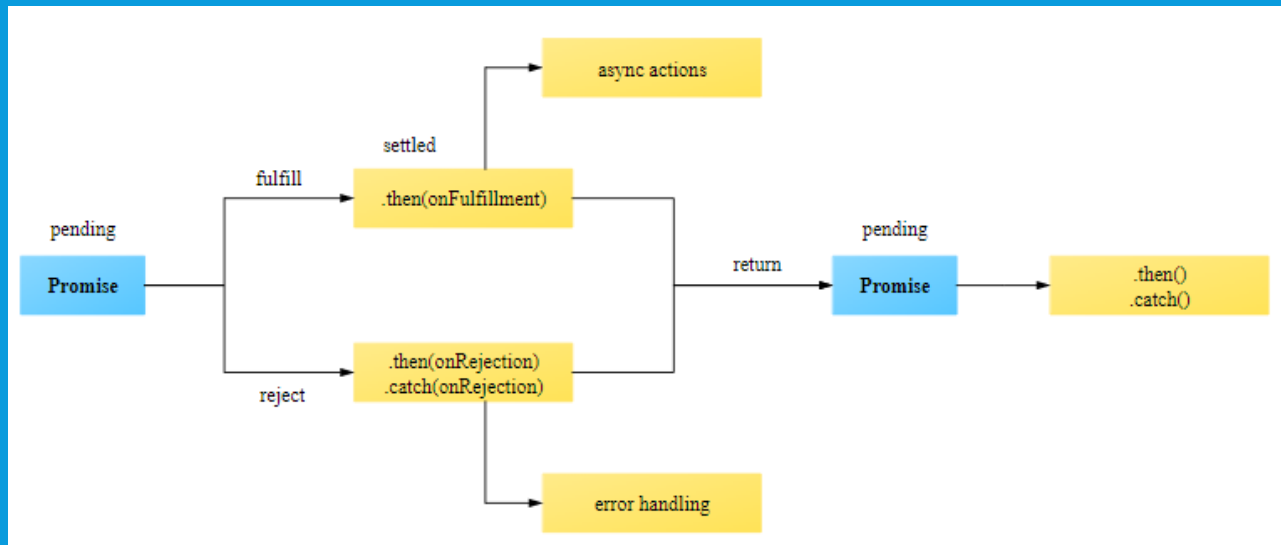
# Consuming Services Overview

- Service calls are typically async
- ES 6 fetch @ moment only supported by Chrome -> \$.ajax
- 3 implementation paths
  - \$.ajax -> success
  - jQuery Deferred
  - await



# ES 6 Promise

- Pattern to deal with async
- 3 States: pending (in progress), fulfilled (success), rejected (error)
- Use `.then()` & `.catch()` for further processing and error handling



# Using ES6 Promises

- ES6 defines Promise
- If transpiling to ES5 reference ES6-shim (<https://github.com/paulmillr/es6-shim>)

```
function doAsyncTask(succeed: boolean): Promise<string> {
  return new Promise<string>((resolve, reject) => {
    setTimeout(() => {
      console.log("Async Task Complete");
      if (succeed) {resolve("Outcome: Promise resolved");}
      else {reject("Outcome: Promise rejected");}
    }, 1000);
  });
}

doAsyncTask(true).then((msg) => {
  console.log(msg);
});
```

# Using jQuery ajax()

- Widely used in JS programming
- Documentation @ <https://api.jquery.com/jquery.ajax/>

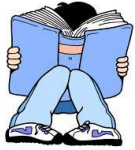
```
import * as $ from "jquery";

$.ajax({
  type: "GET",
  url: this.url,
  contentType: "application/json; charset=utf-8",
  dataType: "json",
  //classic callback pattern
  success: function success(data: any) {
    console.log("Data received from jQuery: ", data);
  },
  //shortcut of callback pattern - function removed
  error(err: any) {
    console.log("Error received from jQuery: ", err);
  }
});
```

# Using fetch & async / await

- ES 6 offeres Fetch API for interacting with HTTP pipeline
- fetch-polyfill available for ES5 (<https://www.npmjs.com/package/fetch-polyfill>)
- await – task pattern from C# implemented in TypeScript -> clearer coding

```
async function getAllVouchers() {  
  let response = await fetch("./demos/vouchers.json");  
  let voucher = await response.json();  
  console.log("Data received");  
  console.log(voucher);  
}  
  
getAllVouchers();
```



# Links & Ressources

- Typescript Website - <http://www.typescriptlang.org/docs>
- Samples- <https://github.com/Microsoft/TypeScript-Handbook/tree/master/pages>
- Book - <https://www.gitbook.com/book/basarat/typescript/details>
- Cheatsheet - <https://www.sitepen.com/blog/2013/12/31/typescript-cheat-sheet/>

Demo



# Using TypeScript

- [VouchersTypeScript -> Demos -> demo.html](#)