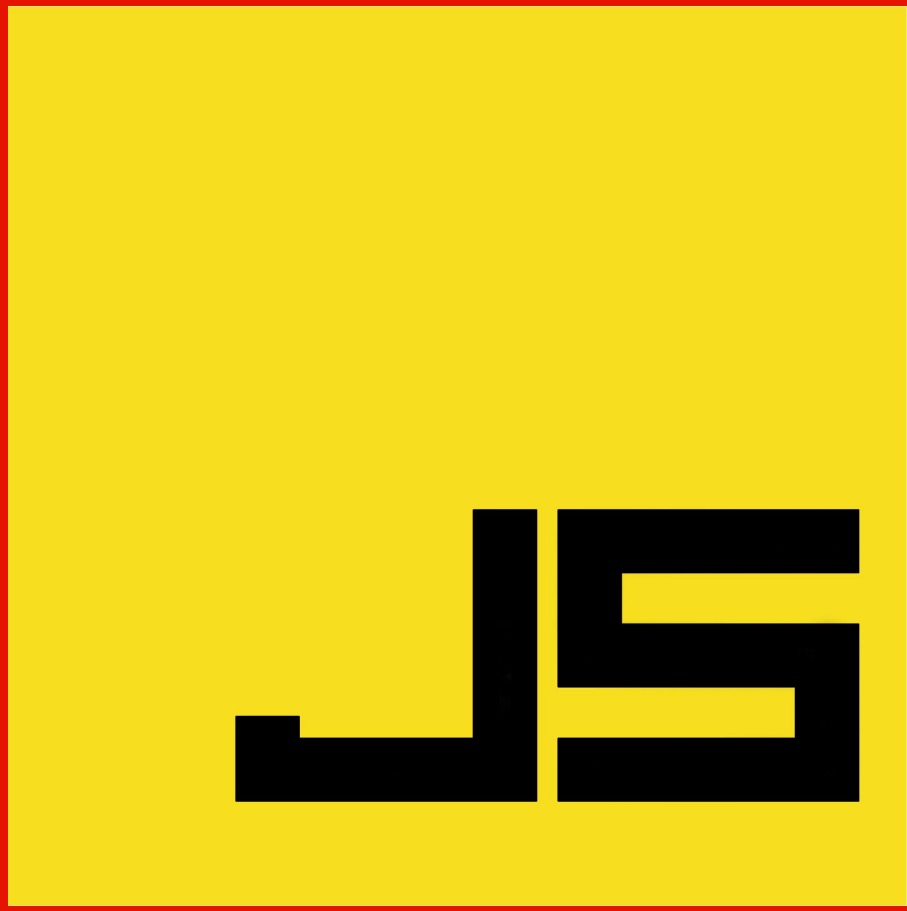
JavaScript Developer Foundation



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Agenda

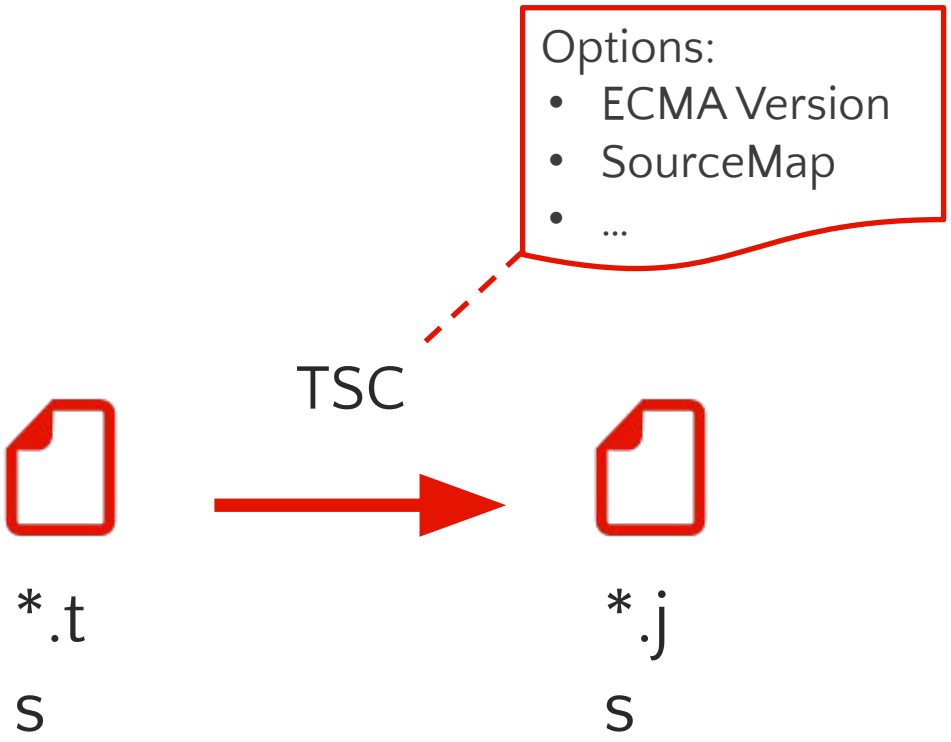
- TypeScript
- CoffeeScript
- asm.js

TypeScript

TypeScript

- Open Source
- Public Roadmap
  https://github.com/Microsoft/TypeScript/wiki/Roadmap
- Superset of JavaScript
- Transpiles to ES3, ES5, or ES6 □ no special runtime
- First preview in 2012, 1.0 in April 2014, 1.5 current

Transpilation



Tooling

- http://www.typescriptlang.org (Playground)
- Visual Studio 2012/2013 TypeScript 1.4 Extension
- Visual Studio 2015 TypeScript 1.5 Built-in
- NodeJS: Command Line | Build Automation
  `npm install -g typescript`

Overview

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

var greeter = new Greeter("world");

var button = document.createElement("button");
button.innerText = "Say Hello";
button.onclick = function() {
    alert(greeter.greet());
}

document.body.appendChild(button);
```

JavaScript

```
function greeter(person) {
    return "Hello " + person;
}

var user = "Bill";

alert(greeter(user));
```

Type Annotation

```
function greeter(person: string) { // any | () => string | { a: number; b: string; }
    return "Hello " + person;
}

var user = "Bill";

alert(greeter(user));
```

Return types

```
function toupper(input: string): string { // void
    return input.toUpperCase();
}
```

Array types

```
var list1: Array<number> = [];
var list2: number[] = [];

list1.push(1);
list1.push("2"); // Error.

list2.push(1);
numArr2list2.push("2"); // Error.
```

Generics

```
function greeter<T>(person: T) {
    return "Hello " + person;
}

var user = "Bill";

alert(greeter<string>(user));
```

Interface

```
interface IPerson {
    firstName: string;
    lastName?: string; // Optional property.
}

function greeter(person: IPerson) {
    return "Hello " + person.firstName + " " + person.lastName;
}

var user = {firstName: "Bill", lastName: "Gates"};

alert(greeter(user));
```

Function type

```
// Interface.
interface SearchFunc {
    (source: string, subString: string): number;
}

var mySearch: SearchFunc = function (source: string, subString: string) {
    return source.search(subString);
}

// Annotation.
var myAdd: (a: number, b: number) => number = function (x, y) { return x + y; };
```

Array type

```
interface StringArray {
    [index: number]: string;
}

var myArr: StringArray = ["Hello", "world"];


interface Dictionary {
    [index: string]: string;
}

var myDict: Dictionary = { a: "Hello", b: "world" };
```

Class

```
class Student {
    fullName: string;
    constructor(public firstName, private middleName, public lastName = "") { // Optional param.
        this.fullName = firstName + " " + middleName + " " + lastName;
    }
}



interface IPerson {
    firstName: string;
    lastName: string;
}

function greeter(person: IPerson) {
    return "Hello " + person.firstName + " " + person.lastName;
}

var user = new Student("Bill", "H.", "Gates");

alert(greeter(user));
```

Implements

```
class Student implements IPerson {
    fullName: string;
    constructor(public firstName, private middleName, public lastName = "") { // Optional param.
        this.fullName = firstName + " " + middleName + " " + lastName;
    }
}



interface IPerson {
    firstName: string;
    lastName: string;
}

function greeter(person: IPerson) {
    return "Hello " + person.firstName + " " + person.lastName;
}

var user = new Student("Bill", "H.", "Gates");

alert(greeter(user));
```

Method

```
class Student {
    fullName: string;
    constructor(public firstName, private middleName, public lastName) {
        this.fullName = firstName + " " + middleName + " " + lastName;
    }
    greet() {
        return "Hello " + this.firstName + " " + this.lastName;
    }
}



var user = new Student("Bill", "H.", "Gates");

alert(user.greet());
```

Methods in interfaces

```
class Student implements IPerson {
    fullName: string;
    constructor(public firstName: string, private middleName: string, public lastName: string) {
        this.fullName = firstName + " " + middleName + " " + lastName;
    }
    greet(): string {
        return "Hello " + this.firstName + " " + this.lastName;
    }
}

interface IPerson {
    firstName: string;
    lastName: string;
    greet(): string;
}
```

Getters/Setters

```
class Employee {
    private _fullName: string;

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

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

var employee = new Employee();
employee.fullName = "Bob Smith";

alert(employee.fullName);
```

Module

```
module Sayings {
    export class Student {
        fullName: string;
        constructor (public firstName, private middleName, public lastName) {
            this.fullName = firstName + " " + middleName + " " + lastName;
        }
        greet() {
            return "Hello " + this.firstName + " " + this.lastName;
        }
    }
}


var user = new Sayings.Student("Bill", "H.", "Gates");

alert(user.greet());
```

Static

```
module Sayings {
    export class Student {
        fullName: string;
        constructor (public firstName, private middleName, public lastName) {
            this.fullName = firstName + " " + middleName + " " + lastName;
        }
        greet() {
            return "Hello " + this.firstName + " " + this.lastName;
        }
        static goodbye(name: string) {
            return "Goodbye " + name;
        }
    }
}
```

```
var user = new Sayings.Student("Bill", "H.", "Gates");

alert(Sayings.Student.goodbye(user.fullName));
```

External objects

```
module Sayings {
    export declare class JSEncrypt {
        constructor(options: any);
        encrypt(input: string): string;
        decrypt(input: string): string;
    };
}
```

Multiple files

```
//---------- Validation.ts
module Validation {
    export interface Validator {
    }
}


//---------- StringValidator.ts
/// <reference path="Validation.ts" />
module Validation {
    export class StringValidator implements Validator {
    }
}


//---------- Test.ts
/// <reference path="Validation.ts" />
/// <reference path="StringValidator.ts" />
var stringValidator: Validation.StringValidator = new Validation.StringValidator();
```

Inheritance

```
class animal {
    eats: bool;
    constructor (public name) { };
    move(meters) {
        alert(this.name + " moved " + meters + "m.");
    }
}

class dog extends animal {
    constructor(name) { super(name); };
    move() {
        alert("Barks ...");
        super.move(5);
    }
}
```

Multiple inheritance

```
interface Shape {
    color: string;
}

interface PenStroke {
    penWidth: number;
}

interface Square extends Shape, PenStroke {
    sideLength: number;
}

var square = <Square>{};
square.color= "blue";
square.sideLength = 10;
square.penWidth = 5.0;
```

Enums

```
enum Color {
    red,
    blue,
    green,
}

var myColor = Color.red;
alert(Color[myColor]); // red.
```

Function parameters

```
function buildName(firstName: string, ...restOfName: string[]) {
    return firstName + " " + restOfName.join(" ");
}

var employeeName = buildName("George", "Alexander", "Louis", "of Cambridge");
```

this

```
var person = {
    name: "Bill Gates",
    greeter: function () {
        return function () {
            alert(this.name); // Error.
        };
    }
}

var person = {
    name: "Bill Gates",
    greeter: function () {
        return function () {
            alert(this.name);
        }.bind(this); // Solution 1.
    }
}

var greet = person.greeter();
greet();
```

Lambda

```
var person = {
    name: "Bill Gates",
    greeter: function () {
        var _this = this;

        return function () {
            alert(_this.name); // Solution 2.
        };
    }
}

var person = {
    name: "Bill Gates",
    greeter: function () {
        return () => { // Solution 3.
            alert(this.name);
        };
    }
}

var greet = person.greeter();
greet();
```

Overloading

```
function add(a: string, b: string): string;
function add(a: number, b: number): number;
function add(a: any, b: any): any {
    return a + b;
}

alert(add(1,  2));
alert(add("Hello ", "world"));
alert(add("Hello ", 1234)); // Error.
```

Union Types

```
function f(x: number | number[]) {
  if (typeof x === "number") {
    return x + 10;
  }
  else {
    // Return sum of numbers.
  }
}
```

Type Aliases

```
type PrimitiveArray = Array<string|number|boolean>;
type MyNumber = number;
type Callback = () => void;
```

Type Definition files

```
module zoo {
   function open(): void;
}

declare module "zoo" {
   export = zoo;
}
```

CoffeeScript

Overview

```
# Assignment:
number = 42
opposite = true

# Conditions:
number = -42 if opposite

# Functions:
square = (x) -> x * x

# Arrays:
list = [1, 2, 3, 4, 5]

# Objects:
math =
  root: Math.sqrt
  square: square
  cube: (x) -> x * square x
```

asm.js

JavaScript

```
function DiagModuleJS(stdlib, foreign?, heap?) {
    // Variable Declarations.
    var sqrt = stdlib.Math.sqrt;

    // Function Declarations.
    function square(x) {
        x = +x;
        return +(x * x);
    }

    function diag(x, y) {
        x = +x;
        y = +y;
        return +sqrt(+square(x) + +square(y));
    }

    return { diag: diag };
}
```

use asm

```
function DiagModule(stdlib, foreign, heap) {
    "use asm";

    // Variable Declarations.
    var sqrt = stdlib.Math.sqrt;

    // Function Declarations.
    function square(x) {
        x = +x;
        return +(x * x);
    }

    function diag(x, y) {
        x = +x;
        y = +y;
        return +sqrt(+square(x) + +square(y));
    }

    return { diag: diag };
}
```

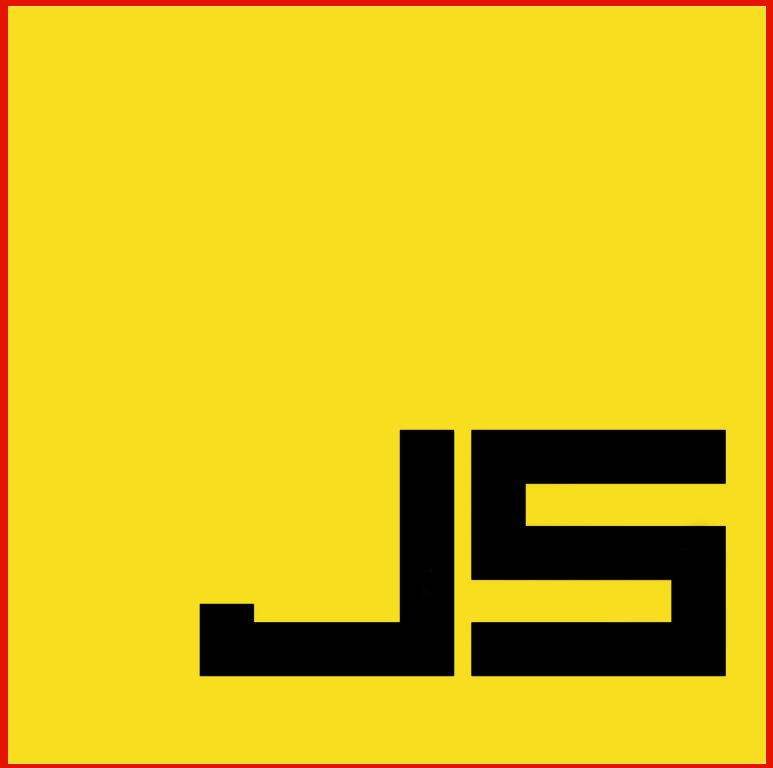
Speed comparison

```
var limit = 1000000;

var diagJs = DiagModuleJS({ Math: Math }).diag;
var start = +new Date();
for (var i = 0; i < limit; i++) {
    var result = diagJs(10, 100);
}
alert("JS: " + (+new Date() - start) + " ms");


var diag = DiagModule({ Math: Math }).diag;
var start = +new Date();
for (var i = 0; i < limit; i++) {
    var result = diag(10, 100);
}
alert("asm.js: " + (+new Date() - start) + " ms");
```

Characteristics

- Only for number types
- Data stored on heap
- No garbage collection or dynamic types
- Fallback to JS if not supported

- ~1.5x slower than compiled C++ (like C# or Java)
- ~4–10x faster than latest browser builds running JS



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