TypeScript

Das bessere JavaScript!?

Christian Kaltepoth / @chkal

Slides: http://bit.ly/wjax16-typescript

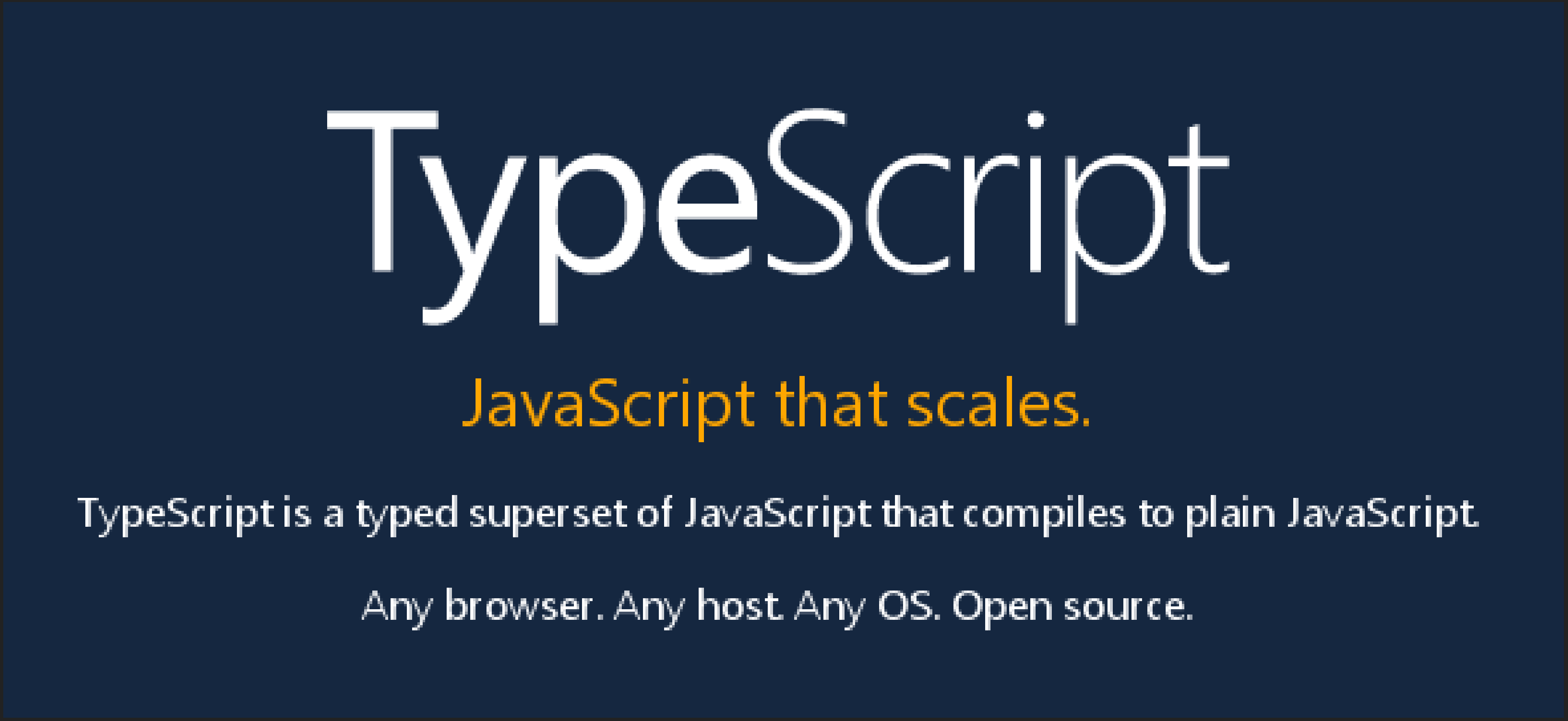
Christian Kaltepoth

Senior Developer @ ingenit

christian@kaltepoth.de / @chkal

http://blog.kaltepoth.de

Why another JavaScript dialect?


TypeScript

JavaScript that scales.

TypeScript is a typed superset of JavaScript that compiles to plain JavaScript.

Any browser. Any host. Any OS. Open source.

Source: http://www.typescriptlang.org/

Dynamic typing is wired

```
"3" + 1     // implicit cast to string
// > "31"

"3" - 1     // implicit cast to number
// > 2
```

```
{} + {}     // > "[object Object][object Object]"
{} + []     // > 0
[] + []     // > ""
```

TypeScript

- ECMAScript 2016
- Type system
- Compiles to ES5

JavaScript

```
var n = 3;
```

TypeScript

```
let n: number = 3;
```

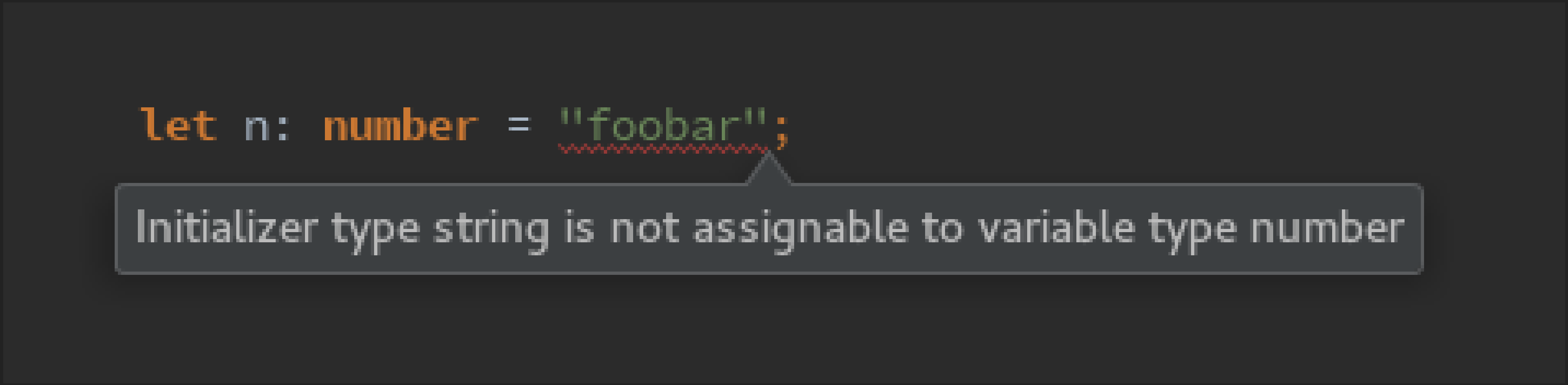
Types are great

```
let n: number = 1;
// > 1

n = 2;
// > 2

n = "foobar";
// Error: Type 'string' is not assignable
//          to type 'number'.
```

Catch errors early



```
let n: number = "foobar";
```

Initializer type string is not assignable to variable type number

Basic Types

Basic types

```
// numbers
let n: number = 42;

// strings
let s: string = "Foobar";

// booleans
let b: boolean = true;

// arrays
let a: number[] = [ 1, 2, 4, 8 ];
```

Enum

```
enum Currency {
  EUR, USD, JPY, GBP
};

let c: Currency = Currency.EUR;

c = "FOOBAR";
// Error: Property 'FOOBAR' does not exist on
//        type 'typeof Currency'.
```

Tuple

```
let price: [ number, string ];

price = [ 12.99, "EUR" ];
// > OK

price = [ "EUR", 12.99 ];
// Error: Type '[string, number]' is not
//        assignable to type '[number, string]'.
```

Any

```
let a: any;

a = "Foobar";

a = false;

a = [ 42, "Foobar", true ];

a = document.getElementById( "foobar" );
```

Type assertions

```
let value: any = "Christian";

(<string>value).substring( 0, 5 );
// > "Chris"
```

```
let value: any = "Christian";

(value as string).substring( 0, 5 );
// > "Chris"
```

Type Inference

```
let n = 3;          // inferred type is 'number'

n = "foobar";
// Error: Type 'string' is not assignable
//        to type 'number'.
```

```
let n = null;         // inferred type is 'any'
if( something ) {
  n = 42;             // OK
  n = "foobar";       // Also OK :-(
}
```

noImplicitAny = true

```
let n = null;              // inferred type is 'any'
if( something ) {
  n = 42;
}
// Error: Variable 'n' implicitly has an 'any' type.
```

```
let n: number = null;      // type specified manually
if( something ) {
  n = 42;
}
// OK
```

Advanced Types

```
let t: string|number;     // union type

t = 42;
// > OK

t = "foobar";
// > OK

t = true;
// Error: Type 'boolean' is not assignable to type
//         'string | number'.
```

Advanced Types

```
type MyType = string|number;    // type alias

let t: MyType = "foobar";
```

```
type Mode = "simple" | "advanced";

let mode: Mode = "simple";

mode = "foobar";
// Error: Type '"foobar"' is not assignable to
//        type 'Mode'
```

Functions

Typed Functions

```
function formatEuro( value: number ): string {
  return value.toFixed( 2 ) + "€";
}
```

```
formatEuro( 42 );
// > "42.00€"
```

Optional Parameters

```
function formatMoney( value: number,
                      currency?: string ): string {

  return value.toFixed( 2 ) + ( currency || "€" );

}
```

```
formatMoney( 42 );
// > "42.00€"

formatMoney( 42, "$" );
// > "42.00$"
```

Default Parameters

```
function formatMoney( value: number,
                      currency: string = "€" ): string {

  return value.toFixed( 2 ) + currency;

}
```

```
formatMoney( 42 );
// > "42.00€"

formatMoney( 42, "$" );
// > "42.00$"
```

Interfaces

Interfaces

```
let money = {
  amount: 42,
  currency: "€"
};
```

```
interface Money {
  amount: number;
  currency: string;
}
```

Using Interfaces

```
interface Money {
  amount: number;
  currency: string;
}

let money: Money = {
  amount: 42,
  currency: "€"
};

let amount = money.amount;      // OK

let currency = money.curency;
// Error: Property 'curency' does not exist on type
```

Functions

```
interface Money {
  amount: number;
  currency: string;
  asString: () => string;
}

let money: Money = {
  amount: 42,
  currency: "€",
  asString: function(): string {
    return this.amount.toFixed( 2 ) + this.currency;
  }
};

money.asString();      // > 42.00€
```

Function Types

```
interface AsStringFunc {
  (): string;
}

interface Money {
  amount: number;
  currency: string;
  asString: AsStringFunc;
}

let money: Money = { ... };

money.asString();     // > 42.00€
```

Extending Interfaces

```
interface AsStringFunc {
  (): string;
}

interface Printable {
  asString: AsStringFunc;
}

interface Money extends Printable {
  amount: number;
  currency: string;
}
```

Structural Subtyping

```
interface Foo {
  value: number;
}

interface Bar {
  value: number;
}

let foo: Foo = {
  value: 3
};

let bar: Bar = foo;   // OK
```

Classes

The old way

```
var Money = function ( amount, currency ) {
  this.amount = amount;
  this.currency = currency;
};

Money.prototype.asString = function () {
  return this.amount.toFixed( 2 ) + this.currency;
};

var money = new Money( 42, "€" );

money.asString();
// > 42.00€
```

ECMAScript 2015

```
class Money {

  constructor( amount, currency ) {
    this.amount = amount;
    this.currency = currency;
  }

  asString() {
    return this.amount.toFixed( 2 ) + this.currency;
  }

}

let money = new Money( 42, "€" );
```

TypeScript

```
class Money {

  private amount: number;
  private currency: string;

  constructor( amount: number, currency: string ) {
    this.amount = amount;
    this.currency = currency;
  }

  asString(): string {
    return this.amount.toFixed( 2 ) + this.currency;
  }

}
```

Readonly Properties

```
class Money {

  private readonly amount: number;
  private readonly currency: string;

  constructor( amount: number, currency: string ) {
    this.amount = amount;
    this.currency = currency;
  }

  asString(): string {
    return this.amount.toFixed( 2 ) + this.currency;
  }

}
```

Parameter Properties

```
class Money {

  constructor( private amount: number,
               private currency: string ) {
    // empty
  }

  asString(): string {
    return this.amount.toFixed( 2 ) + this.currency;
  }

}
```

Implementing Interfaces

```
interface Printable {
  asString: () => string;
}

class Money implements Printable {

  constructor( private amount: number,
               private currency: string ) {
    // nothing here
  }

  asString(): string {
    return this.amount.toFixed( 2 ) + this.currency;
  }
}
```

There is more:

- Inheritance
- Abstract classes
- Static properties
- Visibility modifiers
- Accessors
- Generics

Modules

Export / Import

```
// math.ts
export function max( a: number, b: number ): number {
  return a > b ? a : b;
}

export let PI = 3.14156;
```

```
// foobar.ts
import { max, PI } from "./math.ts";

max(9, 13) === 13;              // > true
PI === 3.14156;                 // > true
```

Export / Import

```
// math.ts
export function max( a: number, b: number ): number {
  return a > b ? a : b;
}

export let PI = 3.14156;
```

```
// foobar.ts
import * as math from "./math.ts";

math.max(9, 13) === 13   // > true
math.PI === 3.14156      // > true
```

Export / Import

```
// money.ts
export class Money {

  constructor( private amount: number,
               private currency: string ) {
  }

  asString(): string {
    return this.amount.toFixed( 2 ) + this.currency;
  }
}
```

```
import { Money } from "./money.ts";

let m = new Money( 42, "€" );
```

More ES2016 magic

ES2016 Constants

```
const users = [ "Christian" ];

users.push( "Jim" );
// > 2

users = [ "Bob" ];
// Error: Left-hand side of assignment cannot
//        be a constant or a read-only property.
```

ES2016 Template Strings

```
let name = "Christian";
let count = 213;

let message =
    `Hello ${name}, you have ${count} messages.`;
```

```
let html =
    `<h1>Hello ${name}</h1>
     <p>
       You have ${count} unread messages
     </p>`;
```

Classic Functions

```
let numbers = [ 1, 2, 3, 4, 5, 6, 7, 8, 9 ];

numbers.filter( function(n) {
  return n % 2 !== 0;
} );
// > [ 1, 3, 5, 7, 9 ]
```

ES2016 Arrow Functions

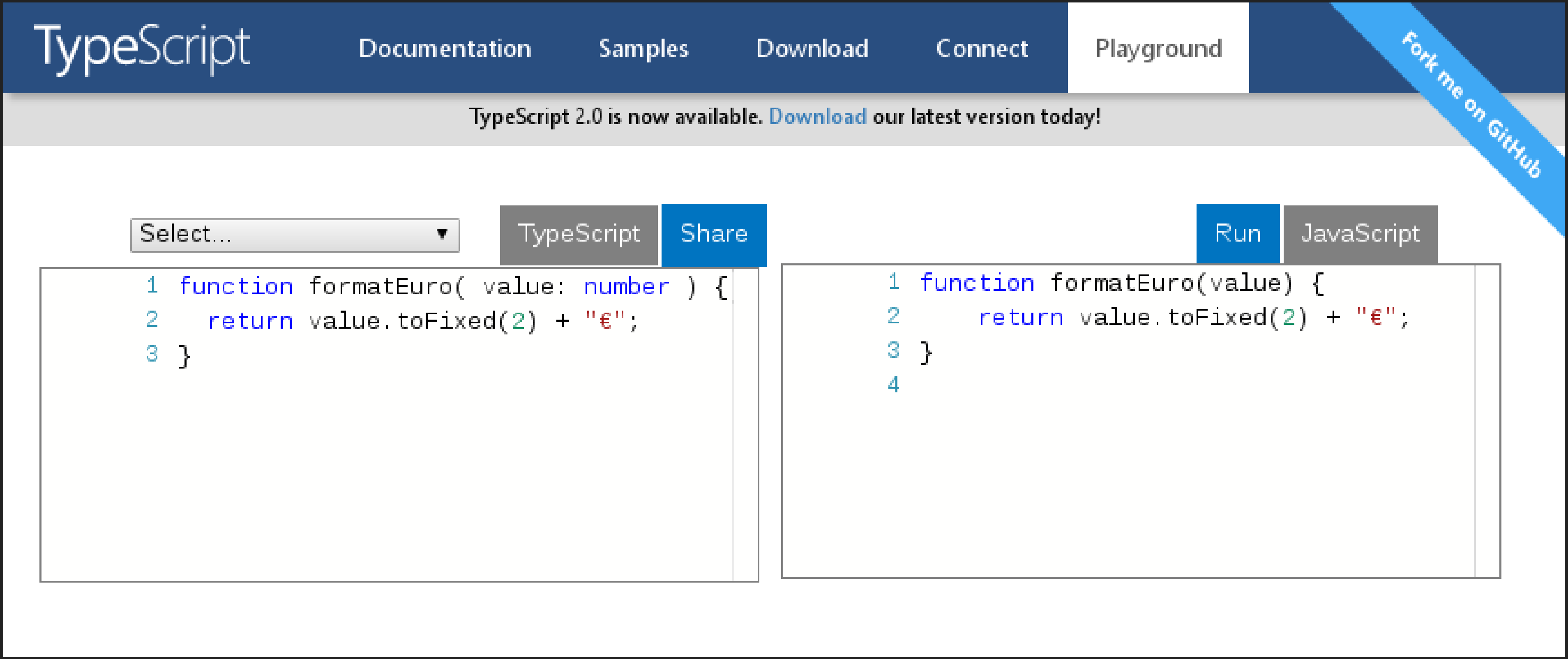
```
numbers.filter( n => {
  return n % 2 !== 0;
} );
// > [ 1, 3, 5, 7, 9 ]
```

```
numbers.filter( n => n % 2 !== 0 );
// > [ 1, 3, 5, 7, 9 ]
```

```
numbers.filter( n => n % 2 );
// > [ 1, 3, 5, 7, 9 ]
```

Give it a try

TypeScript REPL



TypeScript 2.0 is now available. Download our latest version today!

```typescript
function formatEuro( value: number ) {
  return value.toFixed(2) + "€";
}
```

```javascript
function formatEuro(value) {
    return value.toFixed(2) + "€";
}

```

http://www.typescriptlang.org/play/

Java Integration

https://github.com/chkal/frontend-boilerplate

- Apache Maven
- node.js / npm
- Webpack / TypeScript
- Karma / Jasmine

Thanks!

Questions?

http://bit.ly/wjax16-typescript

https://github.com/chkal/frontend-boilerplate

Christian Kaltepoth / @chkal