WARMTEBOUW.

Angular Advanced
Using Signals

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Angular Signals

A new kind of reactivity with signal based primitives,

AKA "The future of Change Detection"

What are signals?

- Change Detection Changed!
  - New: reactive mechanism called *Signals*
- When a signal changes, everything that depends on that signal is also updated.

"A Signal is kind of like a `BehaviorSubject`*, but you don't need to subscribe to it to get the value out – so you can more easily react to signal changes"*

*"A **signal** is a wrapper around a value that notifies interested consumers when that value changes. Signals can contain any value, from primitives to complex data structures."*

You read a signal's value by calling its getter function, which allows Angular to track where the signal is used.

Signals may be

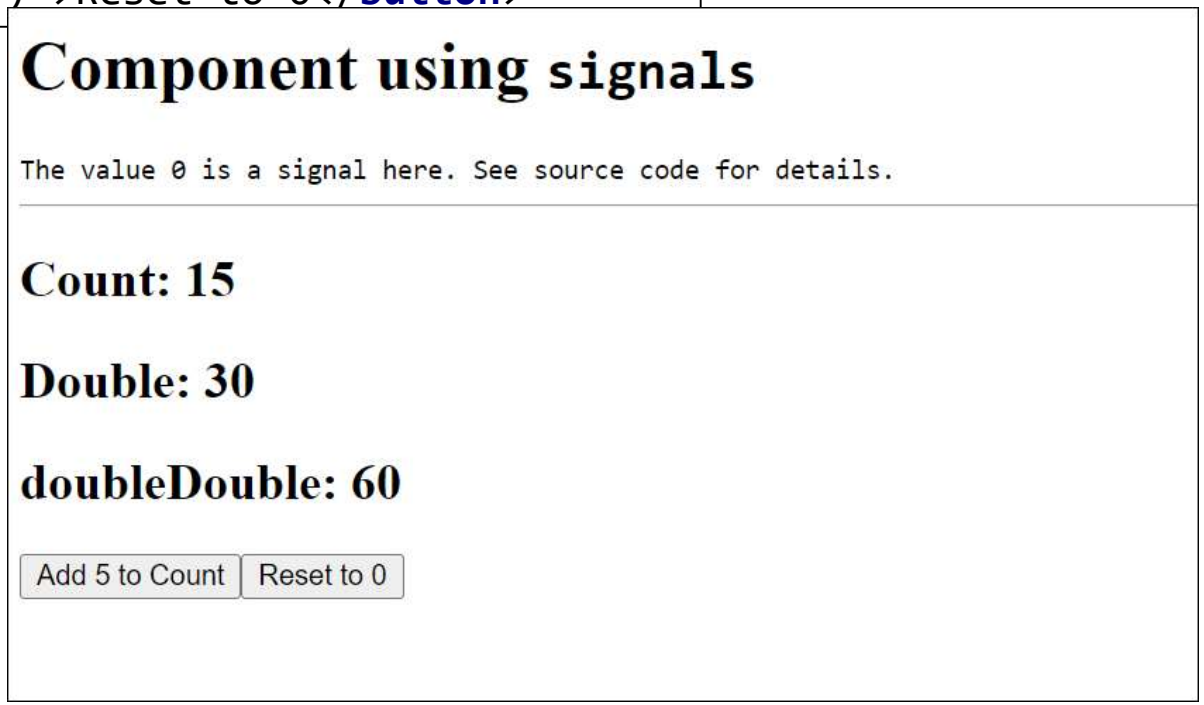
either writable or read-only.

What do simple signals look like?

```
export class SignalsComponent {
  // signal variables
  count = signal(0);
  double = computed(() => this.count() * 2);
  doubleDouble = computed(() => this.double() * 2);

  // methods
  updateCount(value: number) {
    this.count.set(this.count() + value);
  }

  resetCount() {
    this.count.set(0);
  }

}
```

repo: ngx-new-features

```
<!--Value of signals -->
<h2>Count: {{ count() }}</h2>
<h2>Double: {{ double() }}</h2>
<h2>doubleDouble: {{ doubleDouble() }}</h2>
<!--Methods -->
<button (click)="updateCount(5)">Add 5 to Count</button>
<button (click)="resetCount()">Reset to 0</button>
```



Using signals

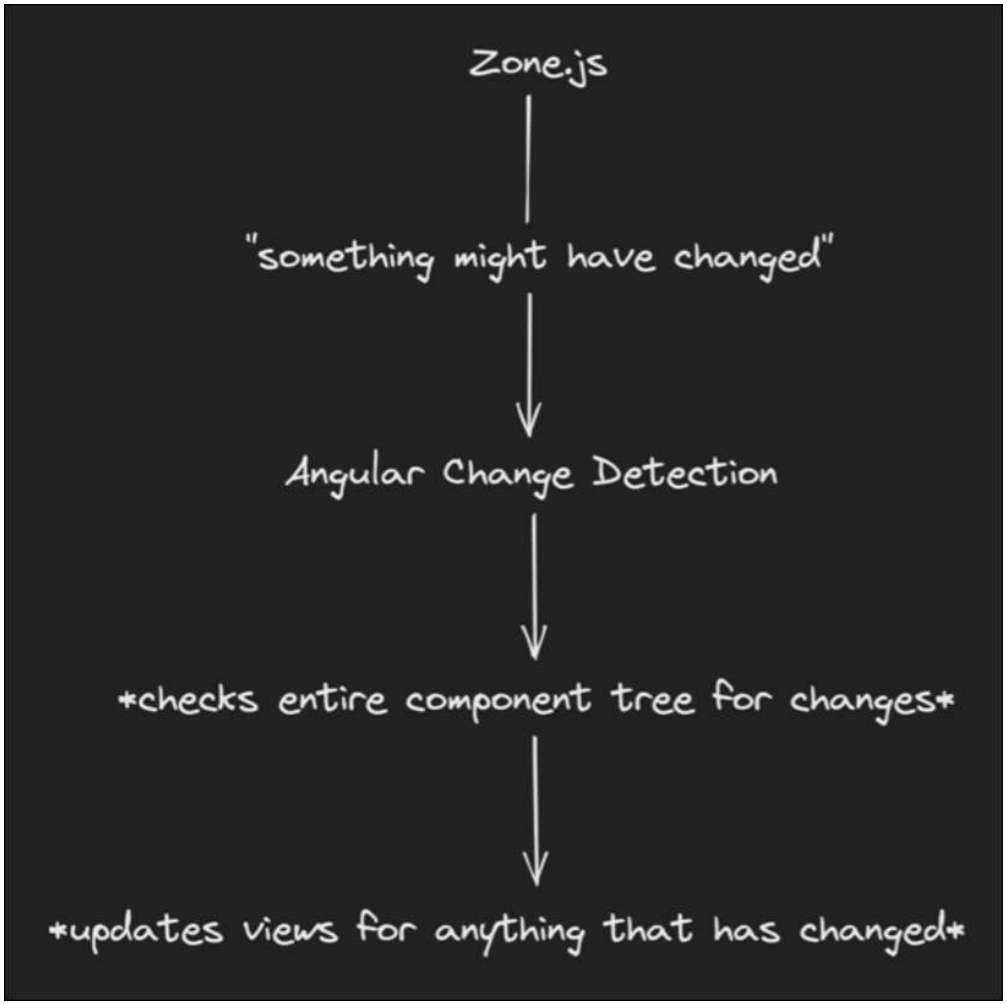
- Note the `()` – notation in the template.
  - `{{ signalName() }}`
  - We want the *value* of the signal. Not the variable itself
  - Hence we call the *getter function* in the template!
- Note the `computed( () => {…})` function.
  - The variable is automatically updated when the signal the variable depends on, changes.
- Signals are for *synchronous* operations.
  - Not suitable (yet?) for asynchrounous statements like `setTimeout()`, http-requests and more.
  - Use RxJS for that.

On Change Detection

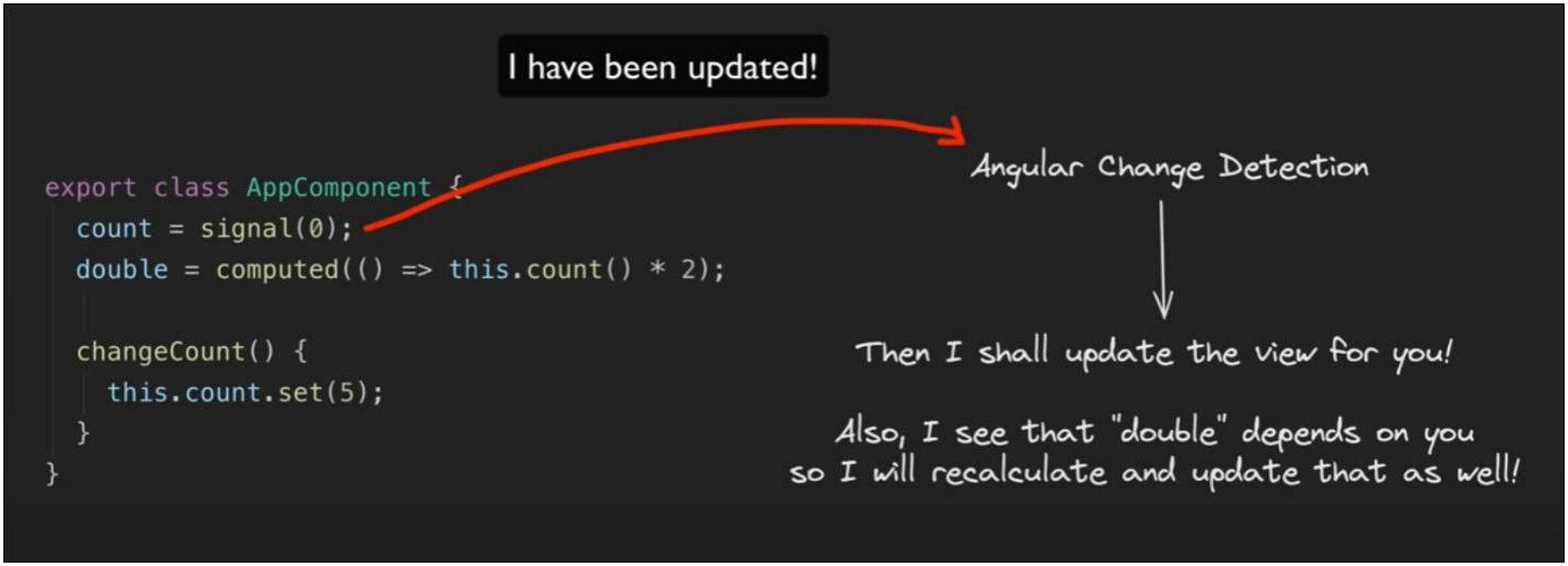
- Classic/Current situation: `zone.js`
- `Zone.js` detects changes
  - `setTimeout()`
  - DOM events
  - `http`-requests
  - …

1. Tells Angular to run CD
2. Angular updates model + DOM
3. Plus all nested components!

- Quite efficiently done by Angular, but still an extra layer of updates.



CD when using `signal`



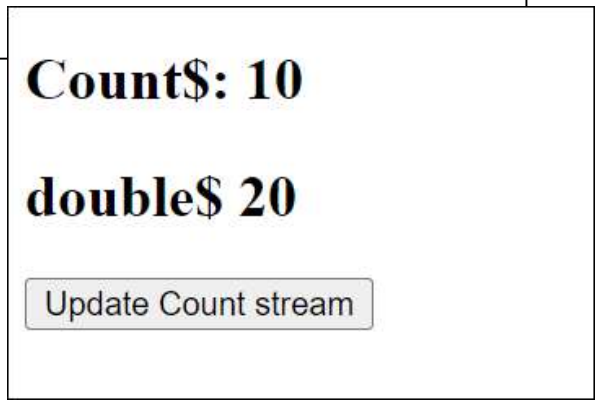
Source: https://www.youtube.com/watch?v=4FkFmn0LmLI

‘Signals’ in the RxJS world

- Previously: use `BehaviorSubject()` to mimic the behavior of a signal
- We have to subscribe to get the data out.
  - `.subscribe()` in the TypeScript file
  - `| async` in the DOM

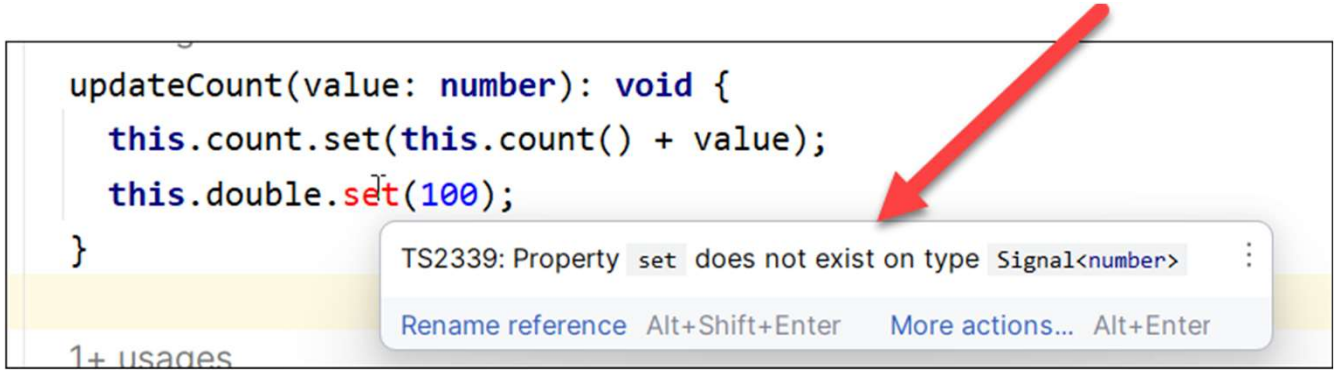
```
// OLD: using RxJS BehaviorSubject:
count$ = new BehaviorSubject(0);
double$ = this.count$.pipe(
  map(count => count * 2)
);

// methods on the stream
updateCountStream(value: number) {
  let count = this.count$.value;
  this.count$.next(count + value);
}
```

```
<h2>Count$: {{ count$ | async }}</h2>
<h2>double$ {{ double$ | async }}</h2>
<button (click)="updateCountStream(5)">
  Update Count stream
</button>
```



Updating a `Signal`

- Change value of a `WritableSignal<T>`, use `.set()`
  - For instance: `this.count.set(5);`
- Updating a value to compute new value from the previous one:
  - For instance: `this.count.update (value => value + 5);`
- Don't directly assign values to computed signals!
  - For instance: `this.double.set(5) // error`



Signal effects

Automatically run code when a signal value changes

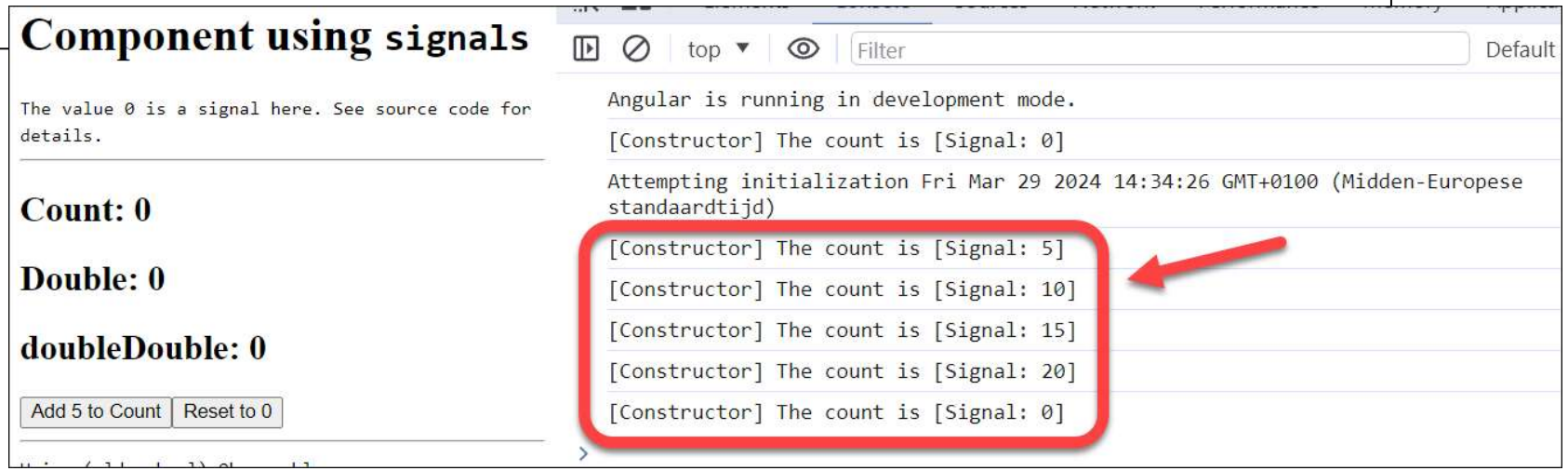
Automatically run operation on signal change

- Effects are also a building block of signals:
    1. Writable Signals
    2. Computed Signals
    3. Effects

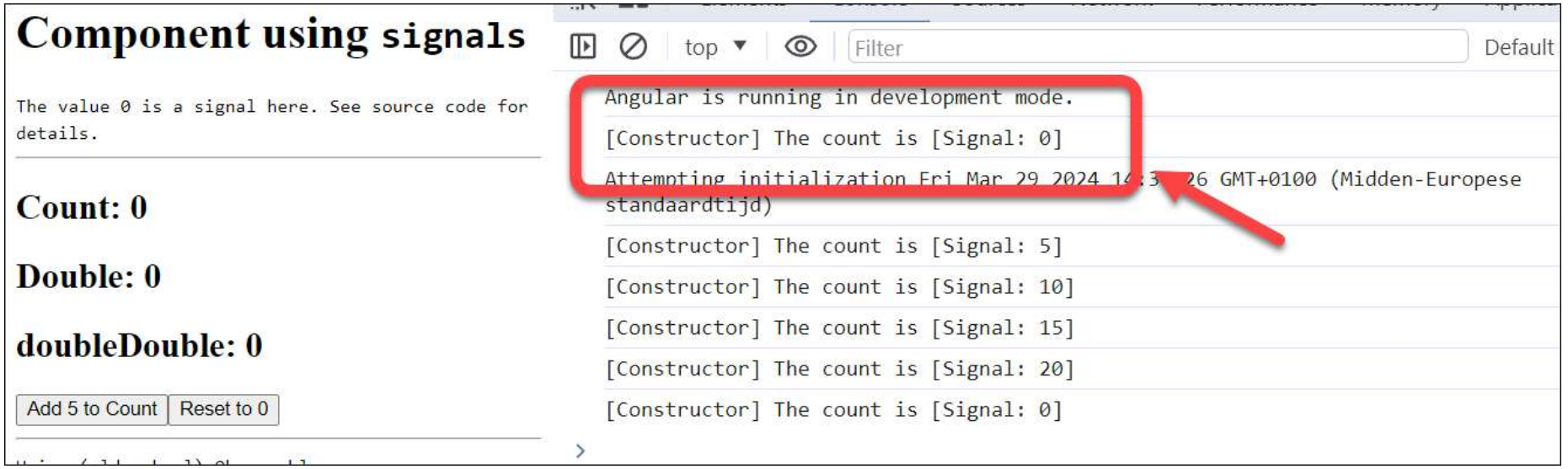
*"An **effect** is an operation that runs whenever one or more signal values change"*

Simple effect

```
constructor() {
  effect(() => {
    console.log('[Constructor] The count is ' + this.count);
  });

}
```



Signals run *at least once*



Whenever the signal value changes,

the effect runs again

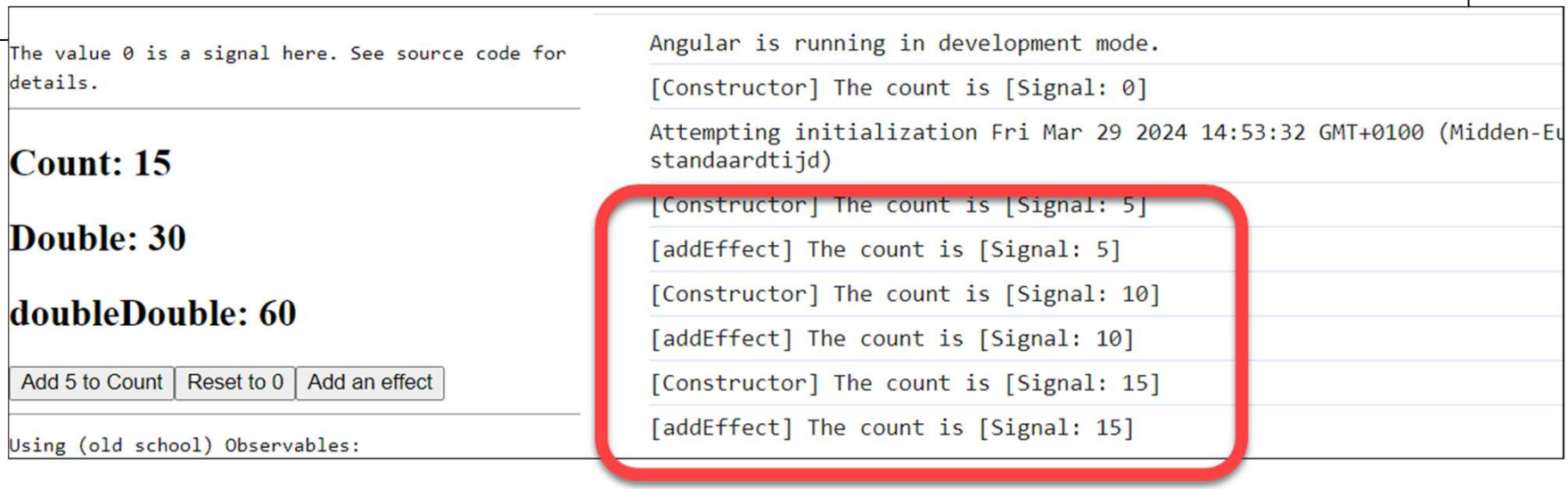
Injection Context

- Effects can only be created inside *injection contexts*
  - Use for instance the `constructor()` of a component:

```
constructor() {
  effect(() => {
    console.log('[Constructor] The count is ' + this.count);
  });
}
```

Alternative – pass `Injector`

```
constructor(private injector: Injector) {
}

// 7. Effects - need an *injection context*. So the example
// below will ONLY WORK if {injector: this.injector} is passed as parameter
addEffect(){
  effect(() => {
    console.log('[addEffect] The count is ' + this.count);
  }, { injector: this.injector});
}
```



OR, using the `inject()` function

```
  injector = inject(Injector);

  addEffect(){
    effect(() => {
      console.log('[addEffect] The count is ' + this.count);
    }, { injector: this.injector});
  }
}
```

Don’t:

Update a signal inside an effect

- When the effect runs, the signal would be updated…
- …this causes the effect to run, which updates the signal…
- …we have created an infinite loop!

```
constructor() {
  effect(() => {
    console.log('[INVALID] The count is ‘ +
        this.count.update(value => value+ 10));
  });
}
```

```
Angular is running in development mode.                                    core.m
▶ERROR Error: NG0600: Writing to signals is not allowed in a `computed` or an `effect` by default. m
Use `allowSignalWrites` in the `CreateEffectOptions` to enable this inside effects.
    at core.mjs:32060:15
    at throwInvalidWriteToSignalError (signals.mjs:407:5)
    at signalUpdateFn (signals.mjs:453:9)
    at signalFn.update (core.mjs:13786:37)
    at EffectHandle.effectFn (signals.component.ts:57:58)
    at EffectHandle.runEffect (core.mjs:15164:18)
```

Workshop

- Create in your app a component that automatically shows if a value is even or odd.
  - Use a `signal()` and `computed()` for that.
  - You must be able to update the signal and show things like "1 = odd", "2= even", etc.
- Optional: use an `effect()` to log the changes to the signal.
  - So: `signal()` ➔ State
  - `computed()` ➔ derived state
  - `effect()` ➔ side effects