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the costs of abstraction

TSconf

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ONCE UPON A TIME...



WHAT IS THE COST OF ABSTRACTIONS?



ehm...

Massimiliano Mantione

Software Engineer

"bla bla blabla bla blabla bla blabla
bla blabla bla blabla bla blabla bla
blabla bla blabla bla blabla bla
blabla bla blabla bla bla"

- bla bla



Google



SIEMENS





Gianluca Carucci

Software Engineer

"Computer programs are the most complex things that humans make."

- Douglas Crockford,
JavaScript: The Good Parts





WHAT COST MEANS?

A cyclist in a green and white Speed Skinsuit is performing a wheelie on a track. The cyclist is leaning forward, holding onto the handlebars. The bicycle has "PINARELLO" and "SKY" written on it. The background is blurred, suggesting motion.

IT'S NOT ALL ABOUT PERFORMANCES

JAVASCRIPT

```
const processor = async (orderId) => {
  const order = await orderService(orderId)
  if (order == null) {
    return {
      success: false
    }
  }
  const validationResult = await validationService(order)
  if (!validationResult.valid) {
    return placedOrderFailed
  }
  return await placeOrderService(order)
}
```

TYPESCRIPT

```
const processor: AsyncProcessor = async (
  orderId: string
): Promise<PlacedOrderResult> => {
  const order = await orderService(orderId)
  if (order == null) {
    return {
      success: false
    }
  }
  const validationResult = await validationService(order)
  if (!validationResult.valid) {
    return placedOrderFailed
  }
  return await placeOrderService(order)
}
```

TYPESCRIPT

- > NO PERFORMANCE PENALTY

TYPESCRIPT

- > NO PERFORMANCE PENALTY
- > COGNITIVE OVERHEAD

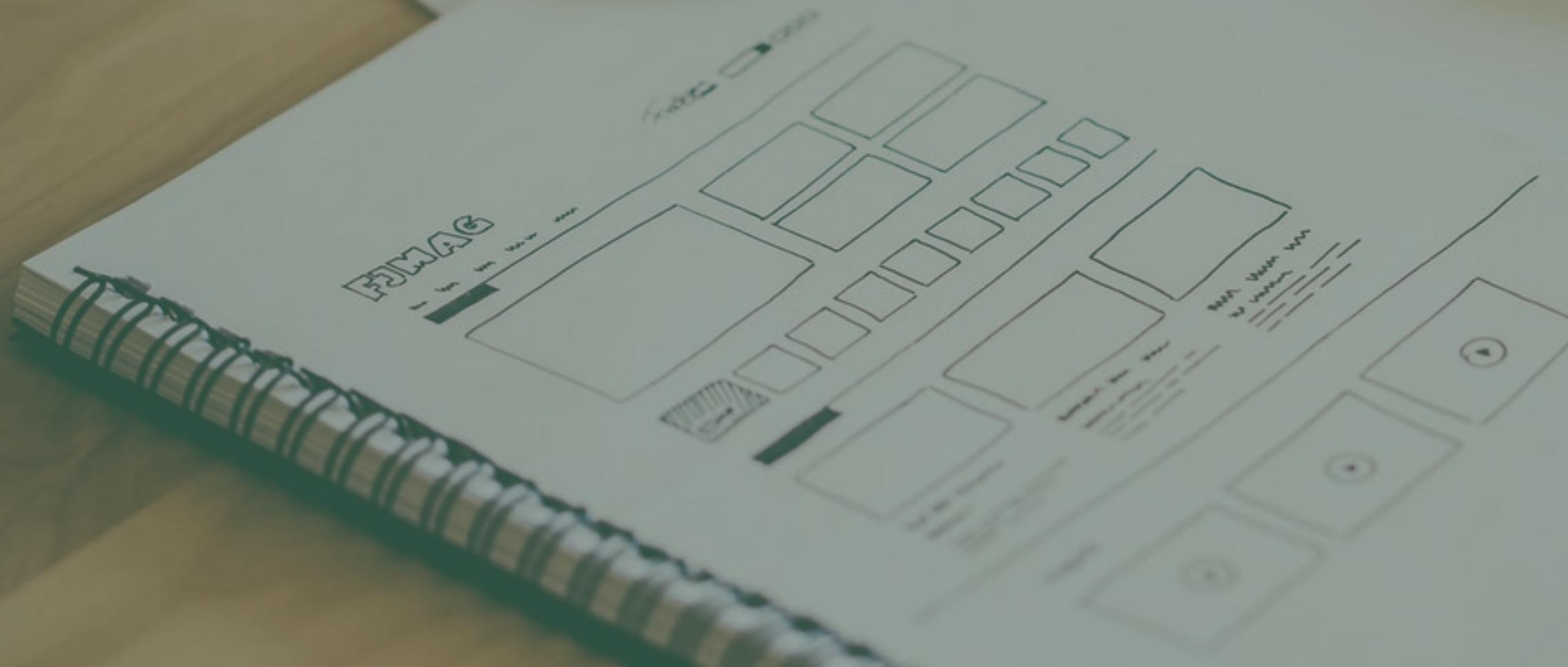


PERFORMANCES MATTER

LET'S GO TO MEASURE

"BUY A BOOK" USE CASE

> CREATE AN ORDER OF BOOKS



"BUY A BOOK" USE CASE

- > CREATE AN ORDER OF BOOKS
- > VALIDATE THE ORDER

"BUY A BOOK" USE CASE

- > CREATE AN ORDER OF BOOKS
 - > VALIDATE THE ORDER
 - > PLACE THE ORDER

BENCHMARK

> 'BUY A BOOK' USE CASE

BENCHMARK

- > 'BUY A BOOK' USE CASE
- > [XXX] DIFFERENT ORDERS

BENCHMARK

- > 'BUY A BOOK' USE CASE
- > [XXX] DIFFERENT ORDERS
- > [YYY]% ORDERS FAIL

BENCHMARK

- > 'BUY A BOOK' USE CASE
- > [XXX] DIFFERENT ORDERS
- > [YYY]% ORDERS FAIL
- > [ZZZ] ITERATIONS



slides



code



environment

A dynamic photograph of a runner in motion on a blue track. The runner's legs are extended forward, and their arms are pumping. They are wearing a dark singlet and shorts. In the background, there are yellow starting blocks with the word "SEIKO" printed on them, and a scoreboard with various numbers and names. The scene is set outdoors on a sunny day.

READY
STEADY
GO!

ASYNC TYPESCRIPT

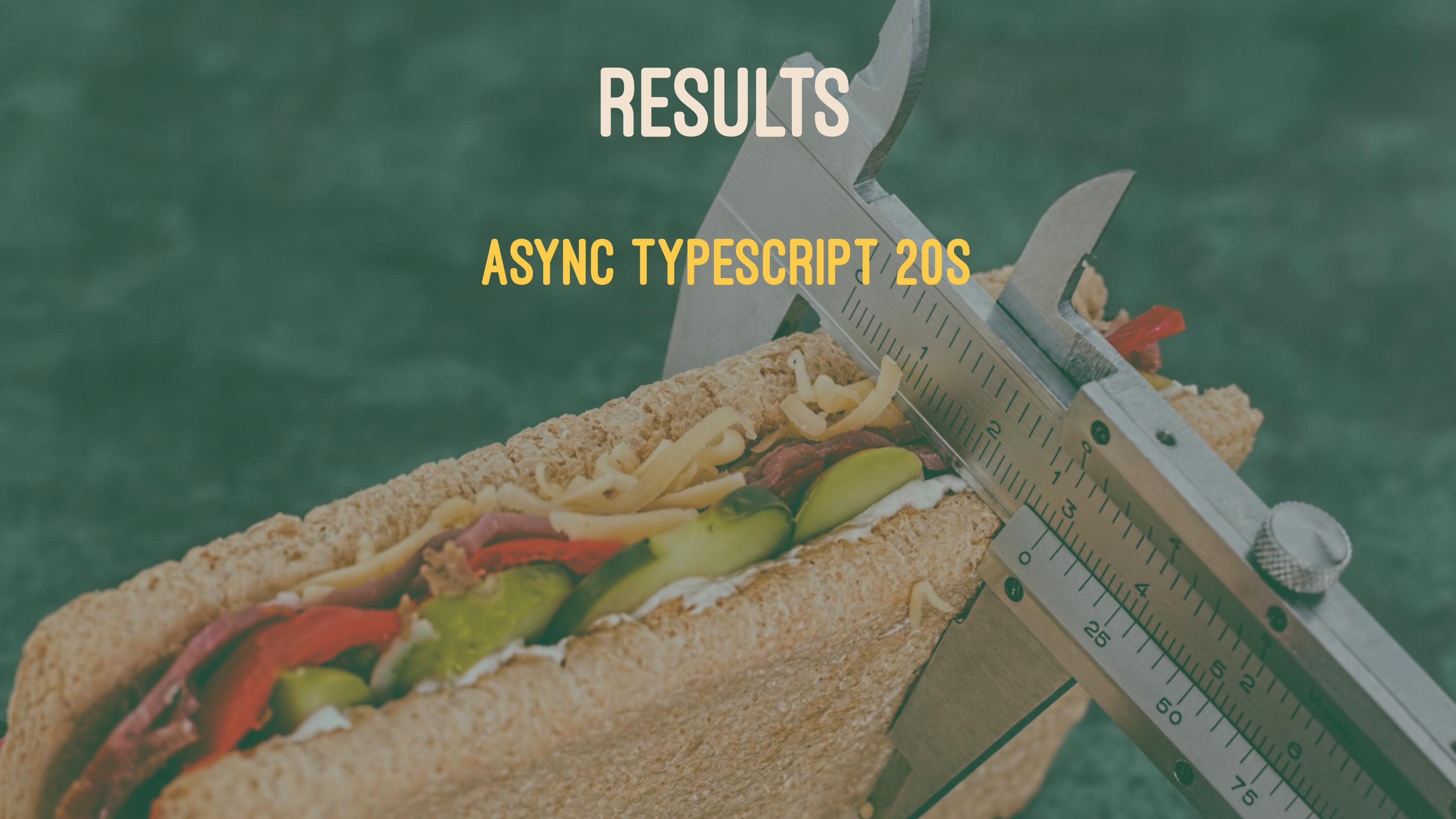
```
const order = await orderService(orderId)
if (order == null) {
  return {
    success: false
  }
}
const validationResult = await validationService(order)
if (!validationResult.valid) {
  return placedOrderFailed
}
return await placeOrderService(order)
```

RESULTS



RESULTS

ASYNC TYPESCRIPT 20S



A photograph of a person's legs and feet as they climb a set of stone steps. The person is wearing blue jeans and grey sneakers with three dark stripes on the side. The steps are made of large, rectangular, reddish-brown stones. In the background, there are more stone structures and some green grass. The overall scene suggests a historical or archaeological site.

NEXT STEP

ADD AN ABSTRACTION LAYER (FP-TS)

FUNCTIONAL JAVASCRIPT

```
return pipe(  
    orderService(orderId),  
    chain(validationService),  
    chain(placeOrderService)  
)
```

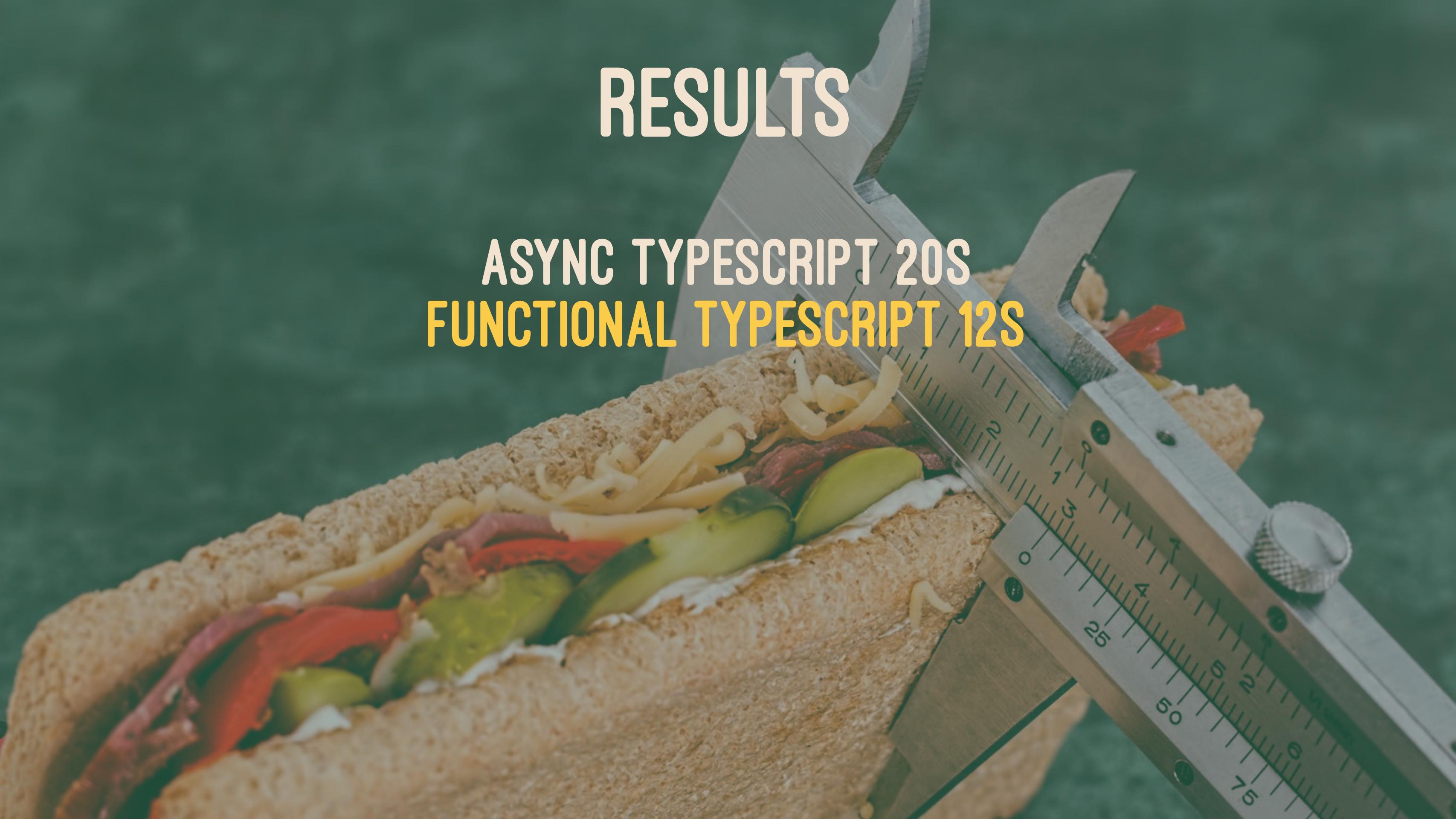
RESULTS

ASYNC TYPESCRIPT 20S



RESULTS

ASYNC TYPESCRIPT 20S
FUNCTIONAL TYPESCRIPT 12S



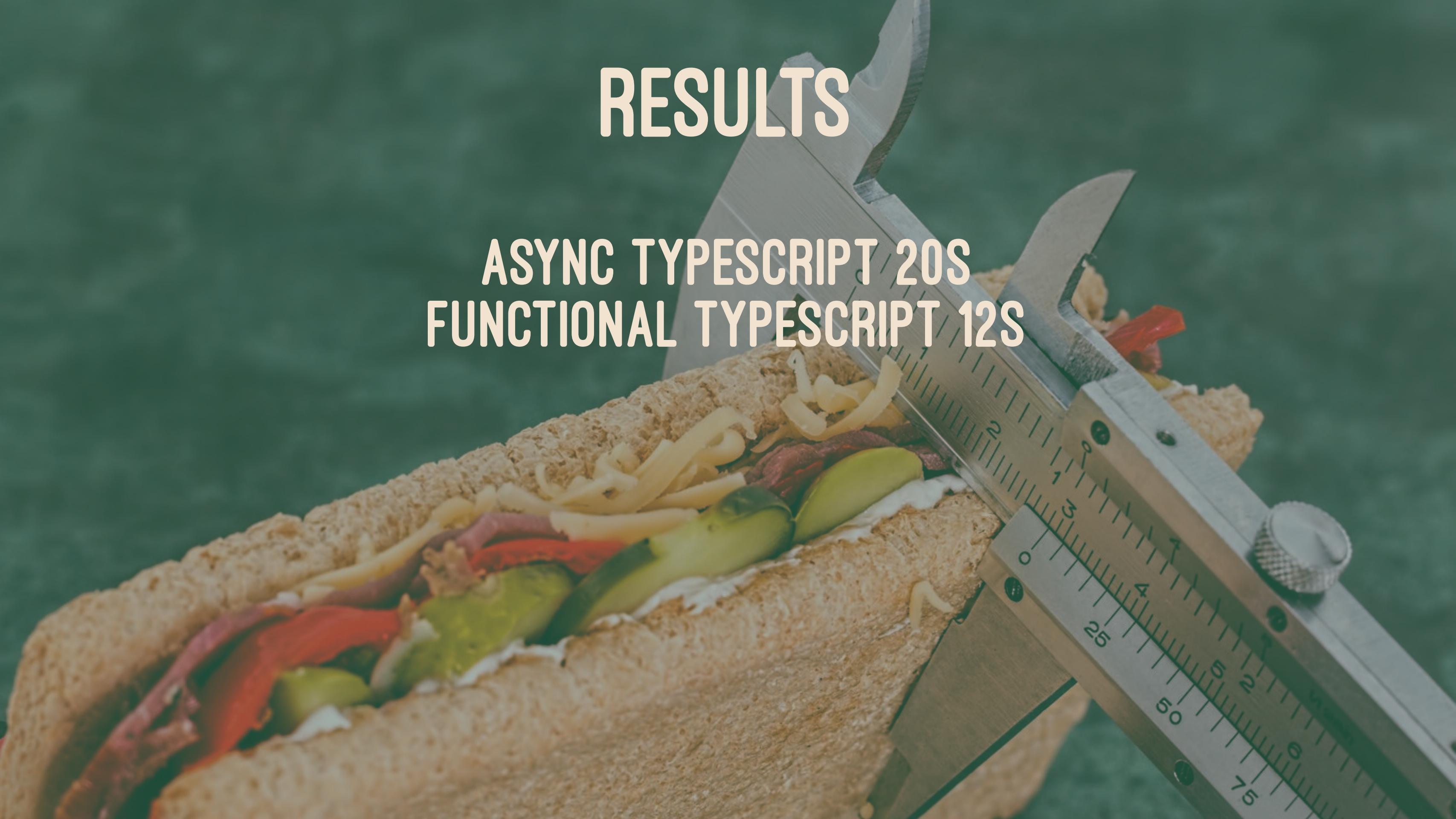
WTF

SOUNDS STRANGE

IS THIS SHIT?

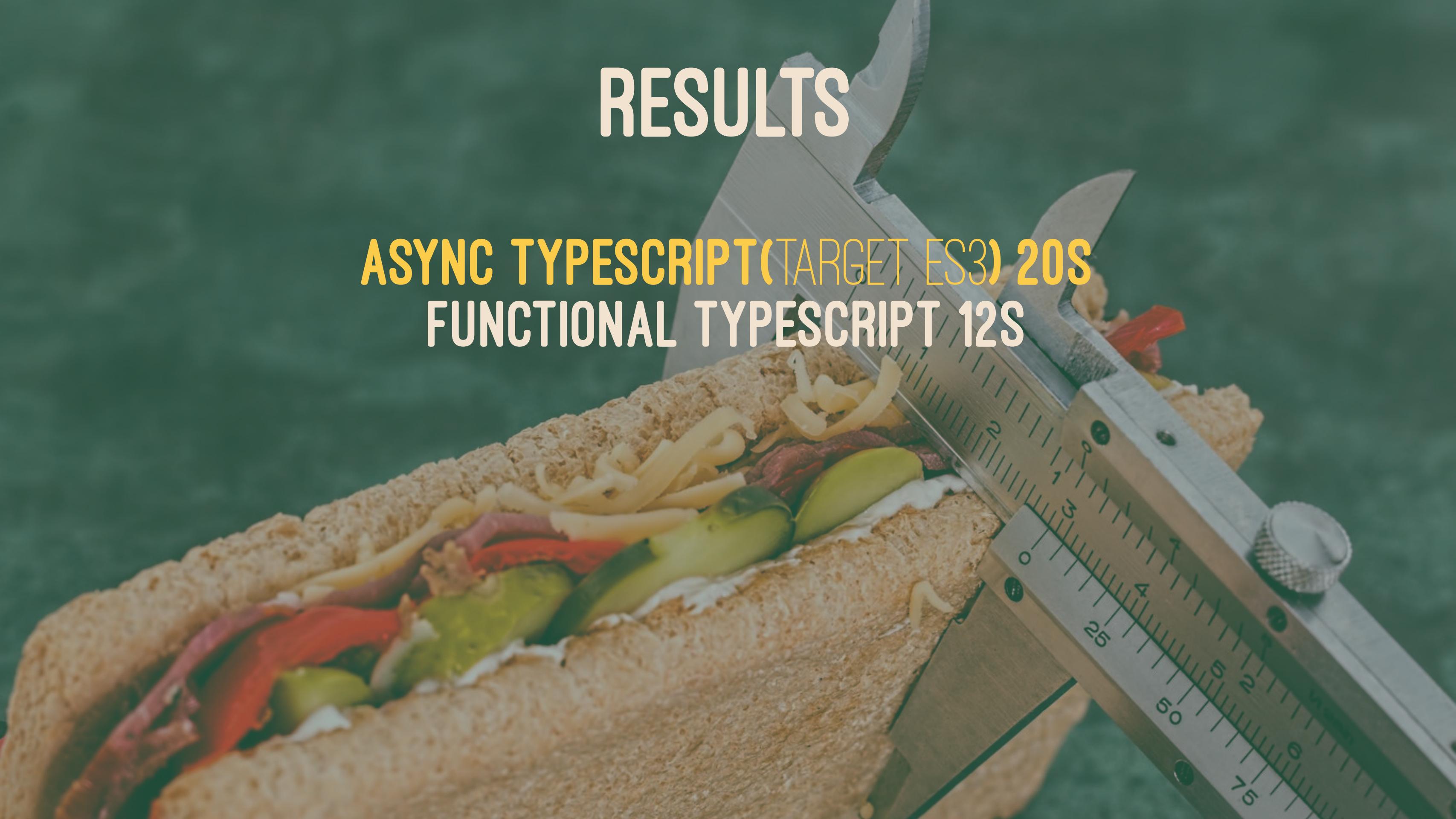
RESULTS

ASYNC TYPESCRIPT 20S
FUNCTIONAL TYPESCRIPT 12S



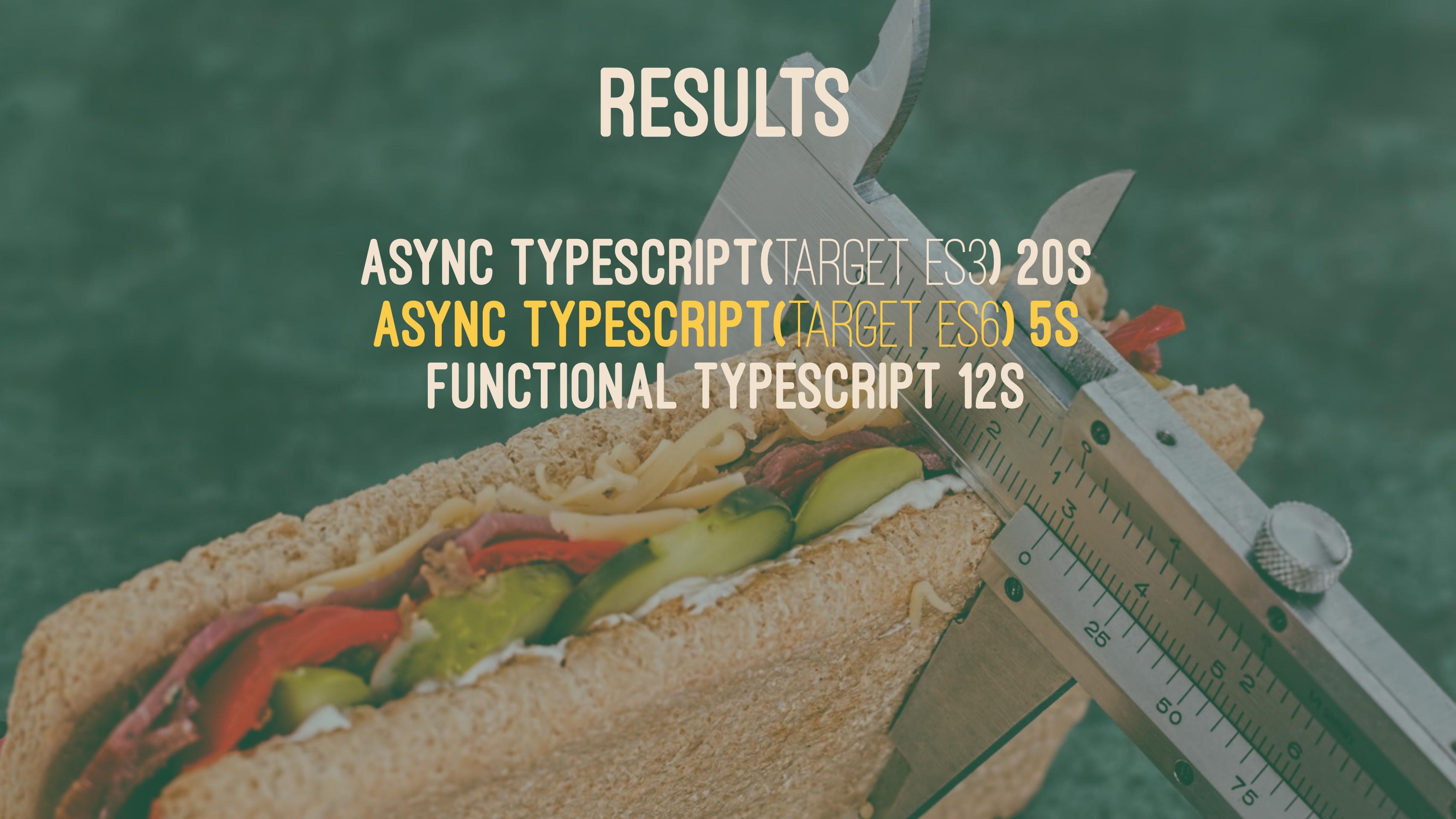
RESULTS

ASYNC TYPESCRIPT (TARGET ES3) 20S
FUNCTIONAL TYPESCRIPT 12S



RESULTS

ASYNC TYPESCRIPT(TARGET ES3) 20S
ASYNC TYPESCRIPT(TARGET ES6) 5S
FUNCTIONAL TYPESCRIPT 12S



LESSONS LEARNED

> SAME CODE COULD HAVE (HUGE) DIFFERENT PERFORMANCE

LESSONS LEARNED

-
- LESSONS LEARNED
- SAME CODE COULD HAVE (HUGE) DIFFERENT PERFORMANCE
 - CHECK DEFAULT COMPILER OPTIONS

A photograph of a person's legs and feet as they climb a set of ancient, weathered stone steps. The person is wearing blue jeans and light-colored sneakers with dark stripes. The steps are made of large, rectangular stones and lead up to a grassy area with more ancient structures in the background under a clear sky.

NEXT STEP

ENFORCE BUSINESS RULES AT COMPILE TIME

CHECKED FUNCTIONAL JAVASCRIPT

```
type NotValid = Left<Error>
type Valid<A> = Right<A>
type Validated<A> = Either<Error, A>

function validationService (o: Order): Validated<Order> {
  const r = validateOrder(order)
  if (r.valid) {
    return valid<Order>(order)
  } else {
    return notvalid(` ${r.error} `)
  }
}
```

CHECKED FUNCTIONAL JAVASCRIPT

```
function calculateAmountService (order: Valid<Order>) {
  return pipe(
    order.right.items.map(item =>
      pipe(
        bookService(item.bookId),
        map(b => b.price * item.quantity)
      )
    ),
    array.sequence(taskEither),
    map(amounts => {
      return amounts.reduce((a, b) => a + b, 0)
    })
  )
}

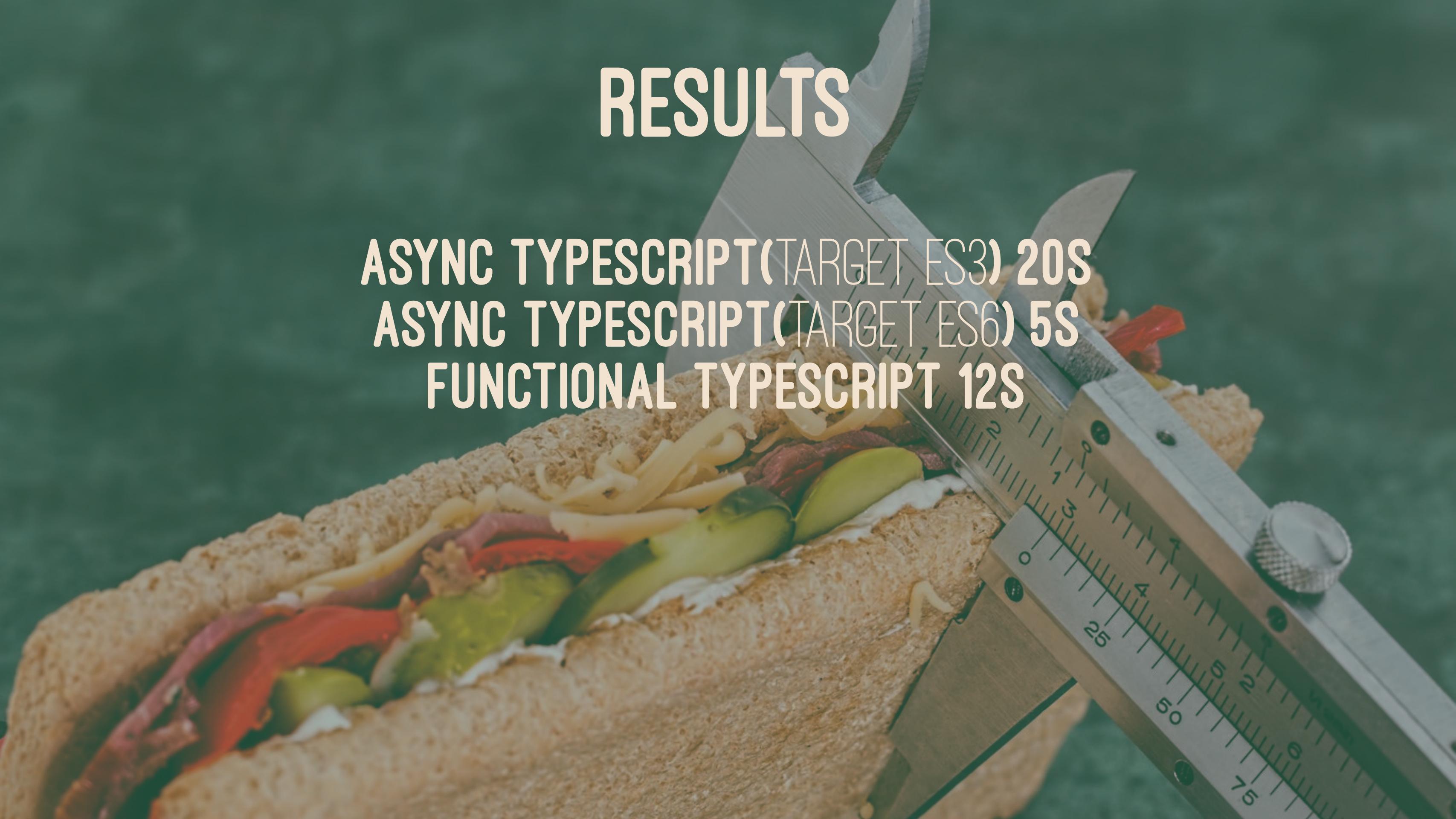
function placeOrderService (order: Valid<Order>) {
  return pipe(
    calculateAmountService(order),
    map(placedOrderSuccess)
  )
}
```

CHECKED FUNCTIONAL JAVASCRIPT

```
return pipe(  
    orderId,  
    orderService,  
    map(validationService),  
    chain(mapTask(placeOrderService))  
)
```

RESULTS

ASYNC TYPESCRIPT (TARGET ES3) 20S
ASYNC TYPESCRIPT (TARGET ES6) 5S
FUNCTIONAL TYPESCRIPT 12S



RESULTS

ASYNC TYPESCRIPT (TARGET ES3) 20S

ASYNC TYPESCRIPT (TARGET ES6) 5S

FUNCTIONAL TYPESCRIPT 12S

CHECKED FUNCTIONAL TYPESCRIPT 12.1S

RESULTS

- > NO PERFORMANCE PENALTY
- > COGNITIVE OVERHEAD

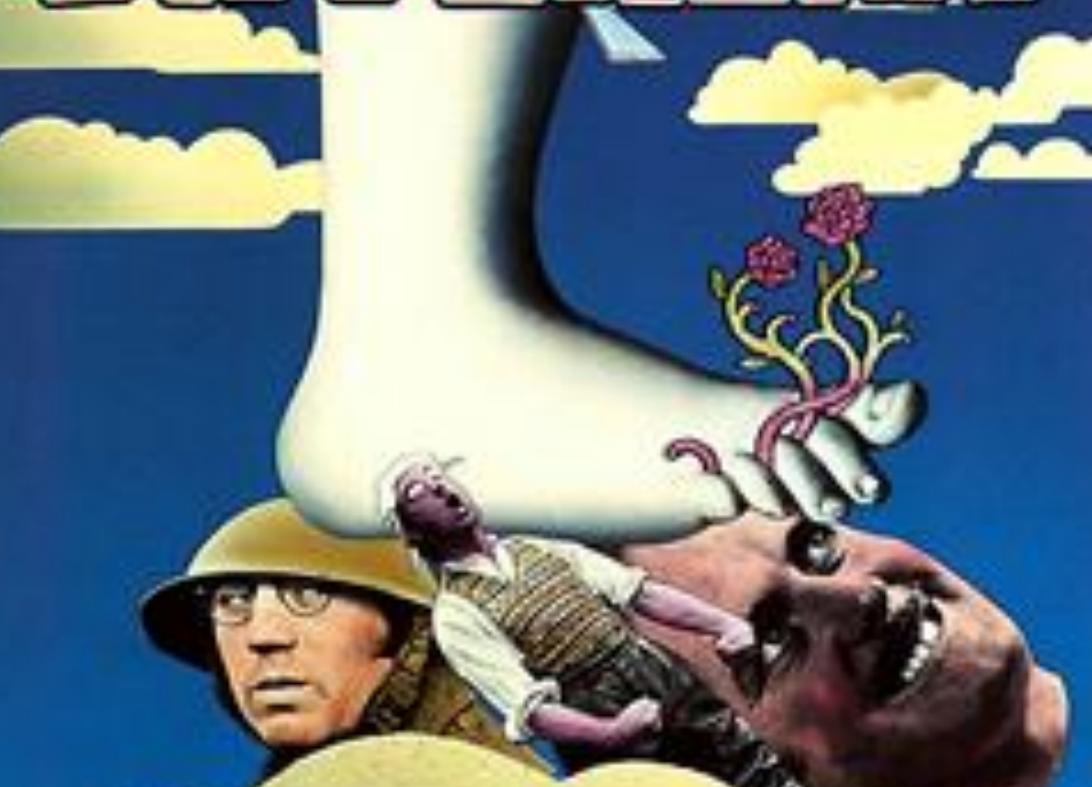


A close-up photograph of a man with a beard and mustache, wearing a plaid shirt. He is holding a deck of cards in his hands, fanning them out slightly. He is looking directly at the camera with a serious expression. The background is dark.

HOW ACHIEVE
THE BEST OF
THE TWO WORLD?

GRAHAM CHAPMAN · JOHN CLESE · TERRY GILLIAM · ERIC IDLE · TERRY JONES · MICHAEL PALIN

MONTY PYTHON'S
**AND NOW FOR
SOMETHING
COMPLETELY
DIFFERENT**



A photograph of a person's legs and feet walking up a set of ancient stone steps. The person is wearing blue jeans and grey sneakers with dark stripes. In the background, there are more stone structures and a few other people. The overall atmosphere is historical and architectural.

NEXT STEP

CHANGE LANGUAGE

The **Rust** programming language



Jump to: [Rust and the future of systems programming](#) [Unlocking the power of parallel](#)

[Safe systems programming with Rust](#) [Growing the Rust community](#) [Putting Rust into p](#)



☞ Rust is a new open-source systems programming language created by Mozilla and a community of volunteers, designed to help developers create fast, secure applications which take full advantage of the powerful features of modern multi-core processors. It prevents segmentation faults and guarantees thread safety, all with an easy-to-learn syntax.

In addition, **Rust offers zero-cost abstractions**, move semantics, guaranteed memory safety, threads with no data races, trait-based generics, pattern matching, type inference, and efficient C bindings, with a minimum runtime size.

overhead



To learn more about Rust, you can:

- Watch the videos below for a closer look at the power and benefits Rust provides.
- Read the book ☞ *The Rust Programming Language* online.
- Download the Rust compiler, check out examples, and learn everything you could

[TBD]

[TBD]

RESULT

ASYNC TYPESCRIPT (TARGET ES3) 20S

ASYNC TYPESCRIPT (TARGET ES6) 5S

FUNCTIONAL TYPESCRIPT 12S

CHECKED FUNCTIONAL TYPESCRIPT 12.1S

RESULT

ASYNC TYPESCRIPT (TARGET ES3) 20S

ASYNC TYPESCRIPT (TARGET ES6) 5S

FUNCTIONAL TYPESCRIPT 12S

CHECKED FUNCTIONAL TYPESCRIPT 12.1S

RUST NATIVE [X]S

SAMSUNG

WHAT ABOUT THE WEB?

A photograph of a person's legs and feet as they climb up a set of stone steps. The person is wearing blue jeans and grey sneakers with dark stripes. The steps are made of large, rectangular stones. In the background, there are more stone structures and some green grass. The overall atmosphere is historical and architectural.

NEXT STEP

SAME CODE FROM NATIVE TO WEBASSEMBLY

RESULT

ASYNC TYPESCRIPT (TARGET ES3) 20S

ASYNC TYPESCRIPT (TARGET ES6) 5S

FUNCTIONAL TYPESCRIPT 12S

CHECKED FUNCTIONAL TYPESCRIPT 12.1S

RUST NATIVE [X]S

RESULT

ASYNC TYPESCRIPT (TARGET ES3) 20S

ASYNC TYPESCRIPT (TARGET ES6) 5S

FUNCTIONAL TYPESCRIPT 12S

CHECKED FUNCTIONAL TYPESCRIPT 12.1S

RUST NATIVE [X]S

RUST WASM [Y]S

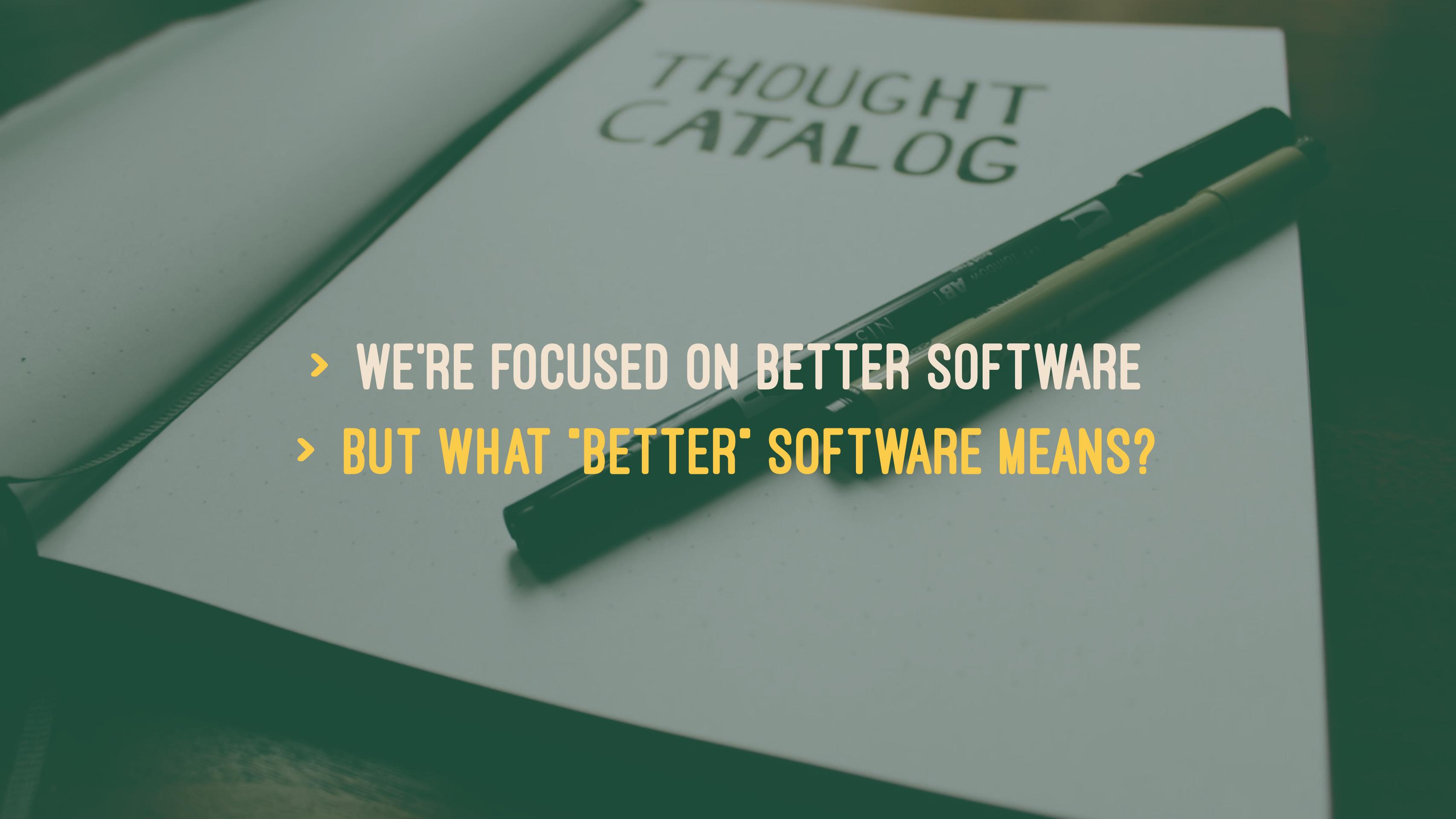
THOUGHT CATALOG





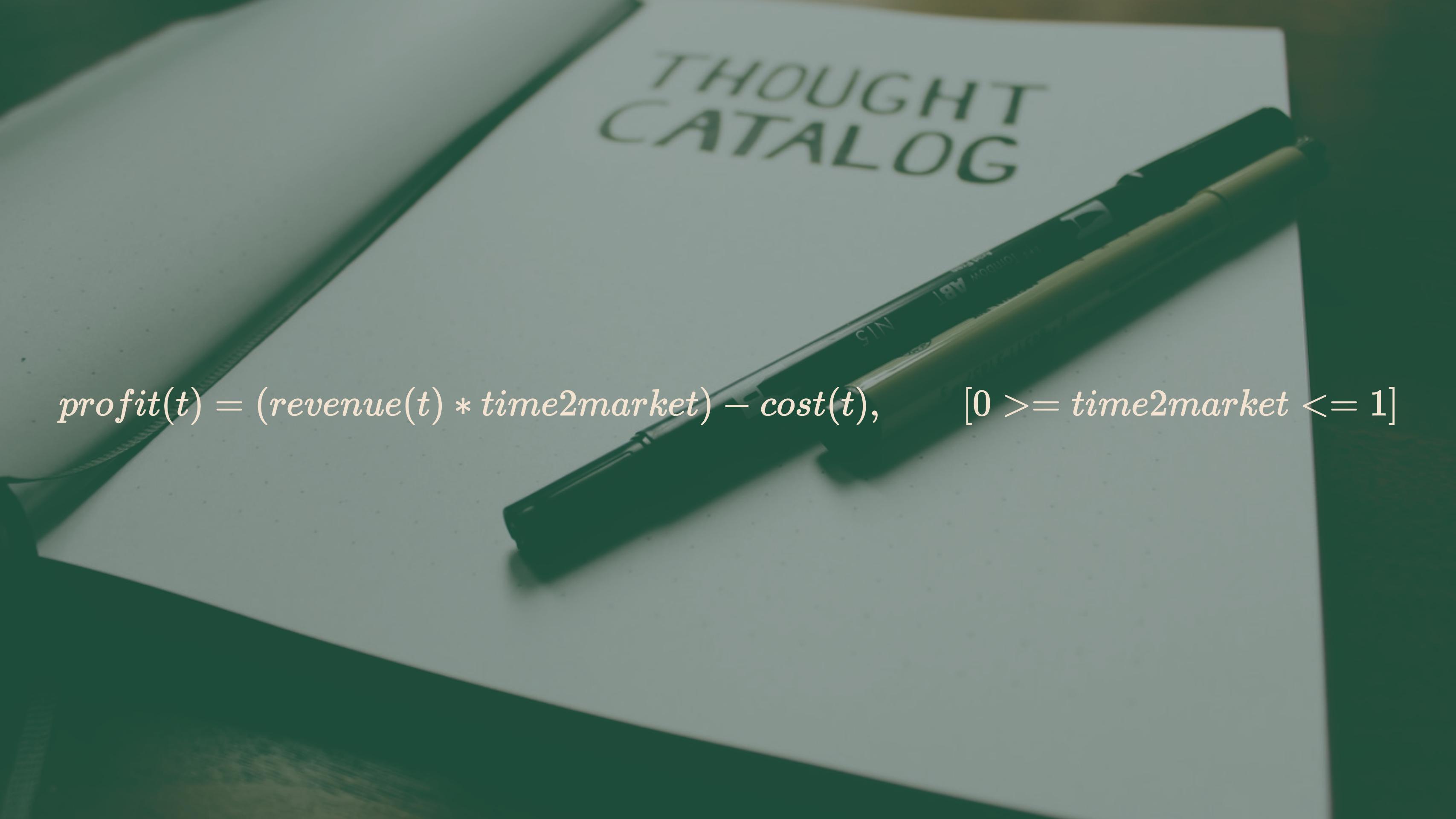
THOUGHT CATALOG

› WE'RE FOCUSED ON BETTER SOFTWARE



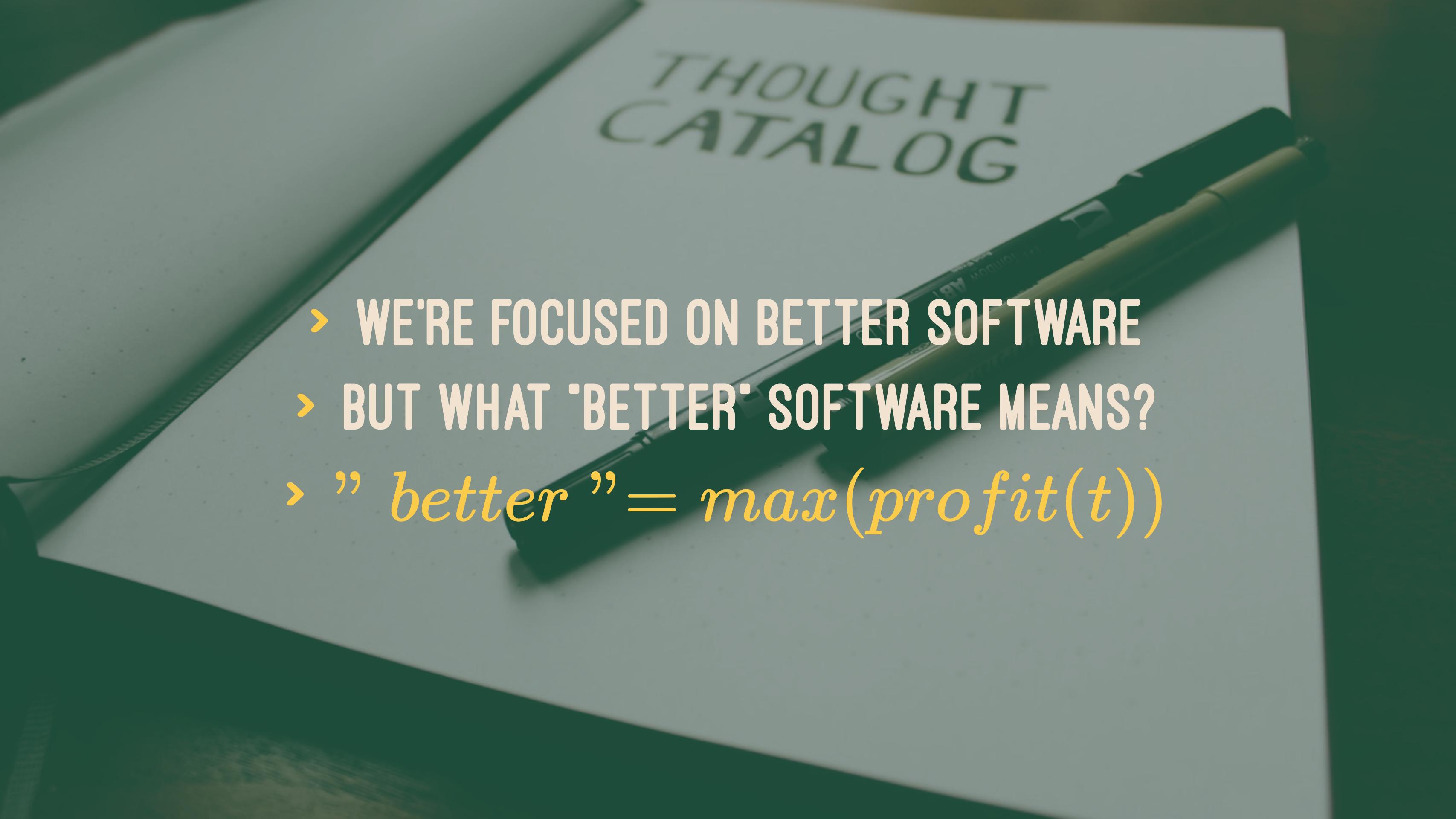
THOUGHT CATALOG

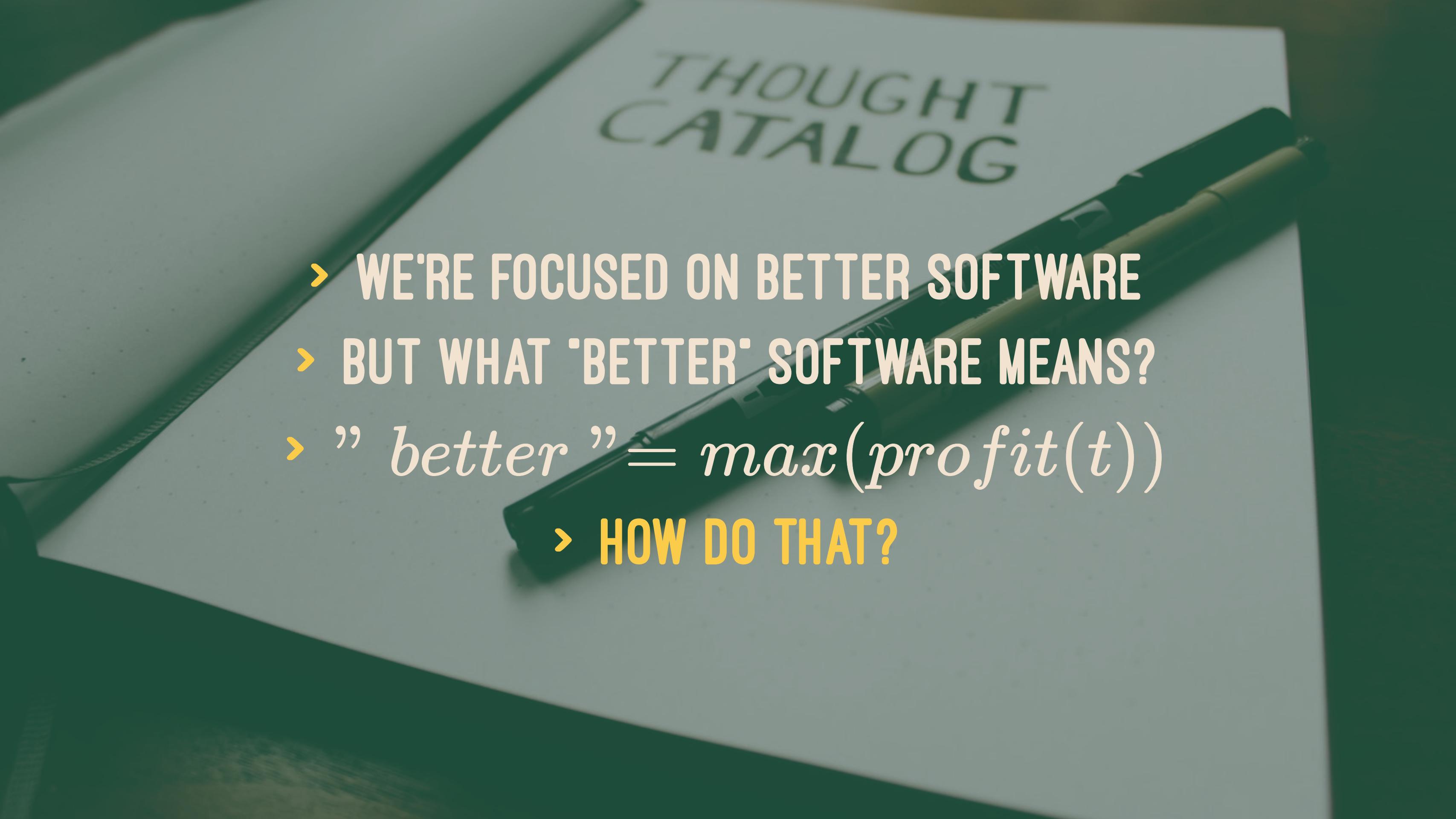
- WE'RE FOCUSED ON BETTER SOFTWARE
- BUT WHAT 'BETTER' SOFTWARE MEANS?



THOUGHT CATALOG

$$profit(t) = (revenue(t) * time2market) - cost(t), \quad [0 >= time2market <= 1]$$

- 
- A close-up photograph of a white notebook with a dark green cover. The words "THOUGHT CATALOG" are printed in a dark green, serif font on the cover. A black pen lies diagonally across the notebook. The background is a solid dark green.
- › WE'RE FOCUSED ON BETTER SOFTWARE
 - › BUT WHAT 'BETTER' SOFTWARE MEANS?
 - › " *better* " = $\max(\text{profit}(t))$



THOUGHT CATALOG

- › WE'RE FOCUSED ON BETTER SOFTWARE
- › BUT WHAT 'BETTER' SOFTWARE MEANS?
- › " *better* " = $\max(\text{profit}(t))$
- › HOW DO THAT?

1P

34200

ONI

50000

2P

3600



Evil Ryu

K.O.

82

Violent Ken



PERFORMANCE
VS
MAINTAINABILITY

SUPER

DESIGN ABSTRACTION

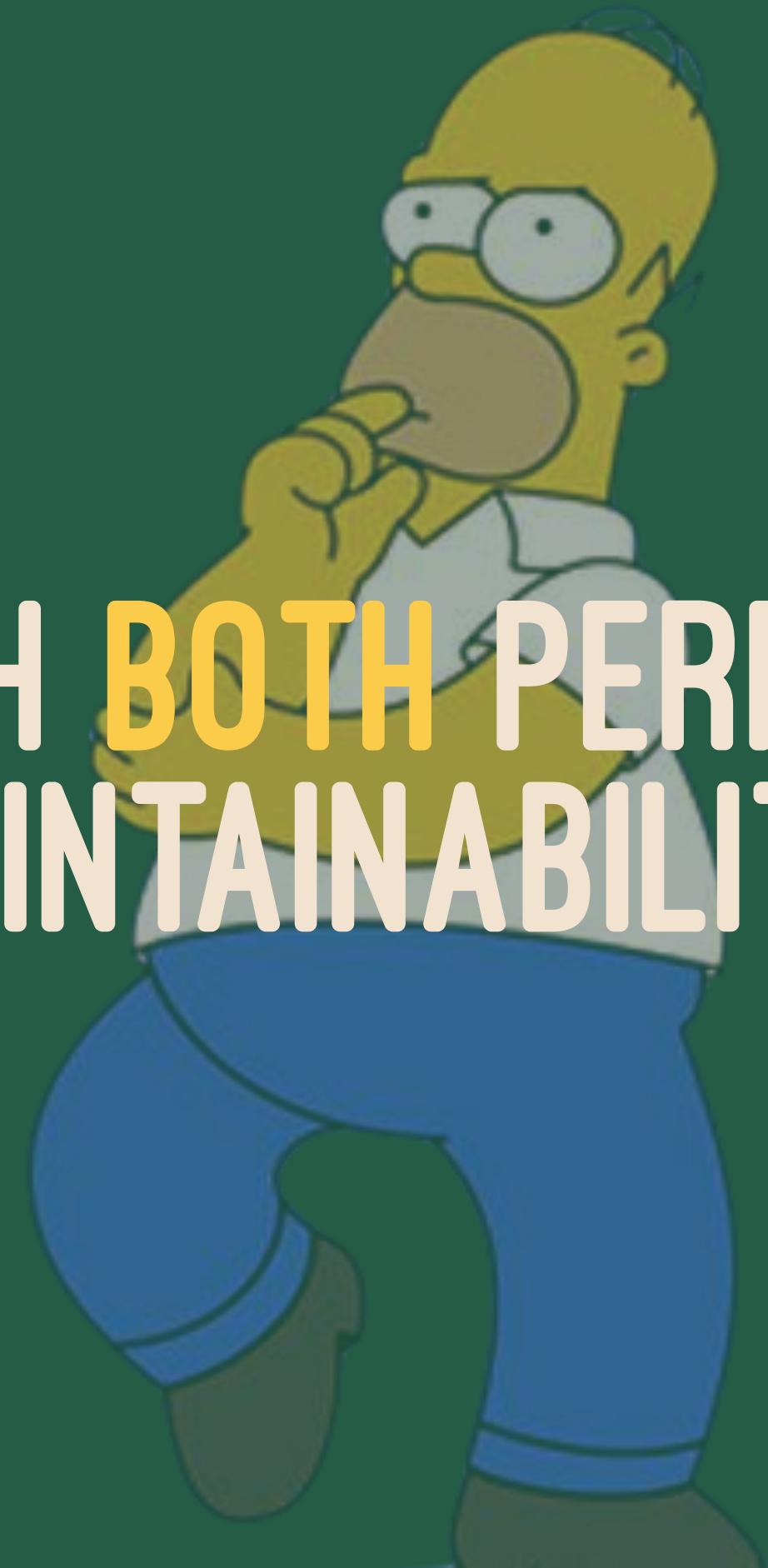
-  PERFORMANCE
-  MAINTAINABILITY

CODE OPTIMISATION ABSTRACTION

-  PERFORMANCE
-  MAINTAINABILITY

BUT...



A cartoon illustration of Homer Simpson from the TV show 'The Simpsons'. He is shown from the waist up, wearing his signature blue shirt and blue pants. He has a thoughtful expression, with his right hand resting against his chin and his left hand on his knee. His eyes are wide and looking upwards and to the side.

CAN WE REACH BOTH PERFORMANCE
AND MAINTAINABILITY?

A cartoon illustration of Homer Simpson from the TV show "The Simpsons". He is shown from the waist up, wearing his signature yellow shirt and tie. His arms are raised in a strong, triumphant gesture, with his fists clenched. He has a determined and excited expression on his face.

RUST IS THE ANSWER!

ZERO ~~COST~~ OVERHEAD ABSTRACTION

BUT...



A cartoon illustration of Homer Simpson from the TV show 'The Simpsons'. He is shown from the waist up, wearing his signature yellow shirt and white pants. He has a look of realization or exasperation on his face. A white speech bubble is positioned above his head, containing the word 'D'oh!' in a dark green, stylized font.

WHAT ABOUT COGNITIVE OVERHEAD?

SUMMARY

- COST HAVE DIFFERENT SHAPES
- ABSTRACTIONS HAVE DIFFERENT SHAPES
 - EACH DECISION **HIDES** A COST
 - THERE ARE **NO** ZERO COST ABSTRACTION
- CHOOSE ABSTRACTION DEPENDING ON THE **CONTEXT**

Thank
you!



QUESTIONS?



slides



code



environment