DevFest Toulouse 2018

Multiplatform projects with Kotlin

Victor Kropp
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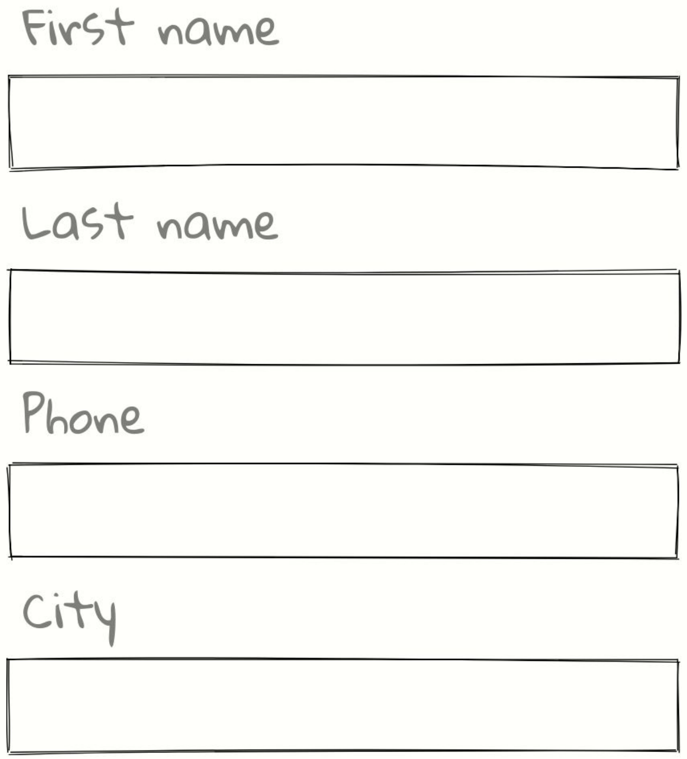
victor.kropp.name

JET BRAINS

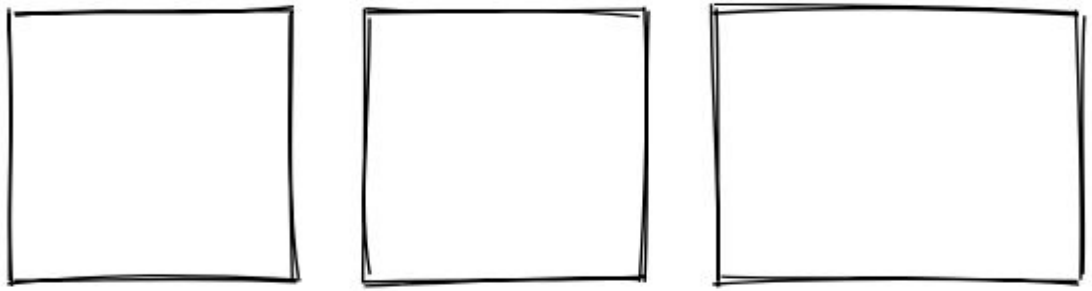
2XU

1261
2XU

2XU
ZONE3
IRONMAN
1261
Victor
M30-34 M

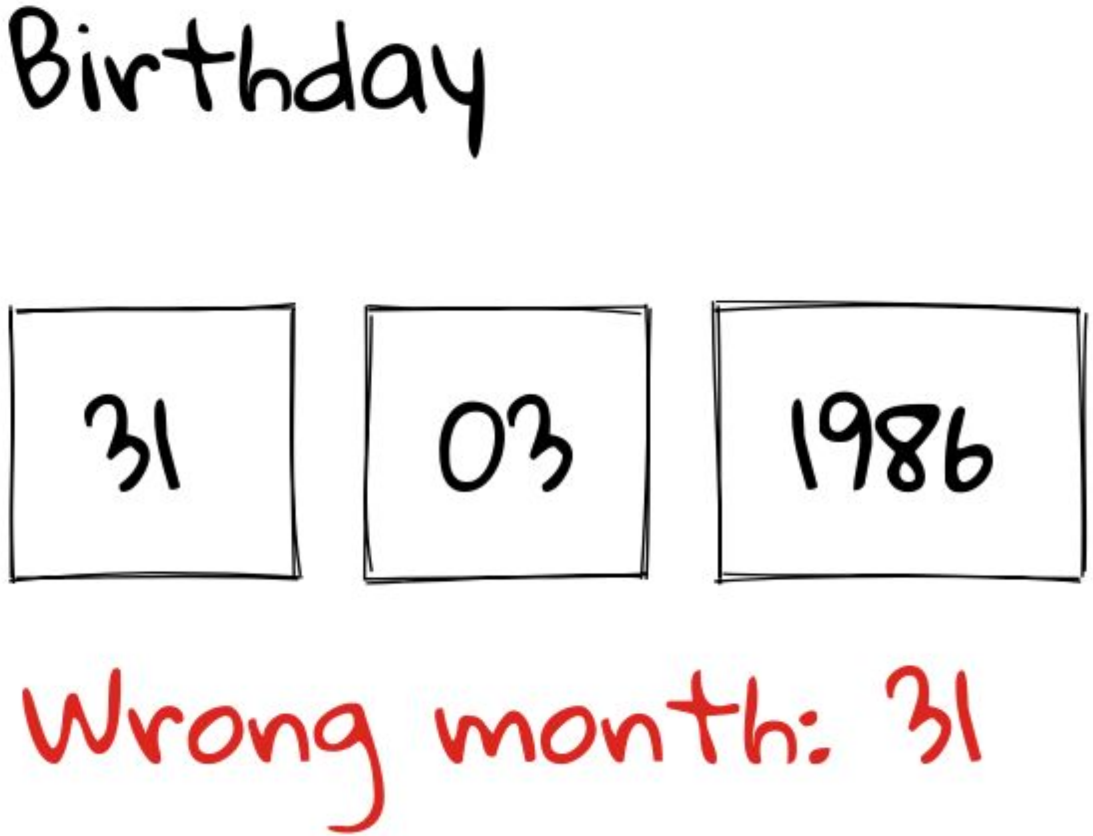

First name
Last name
Phone
City

Birthday



Birthday

31	03	1986



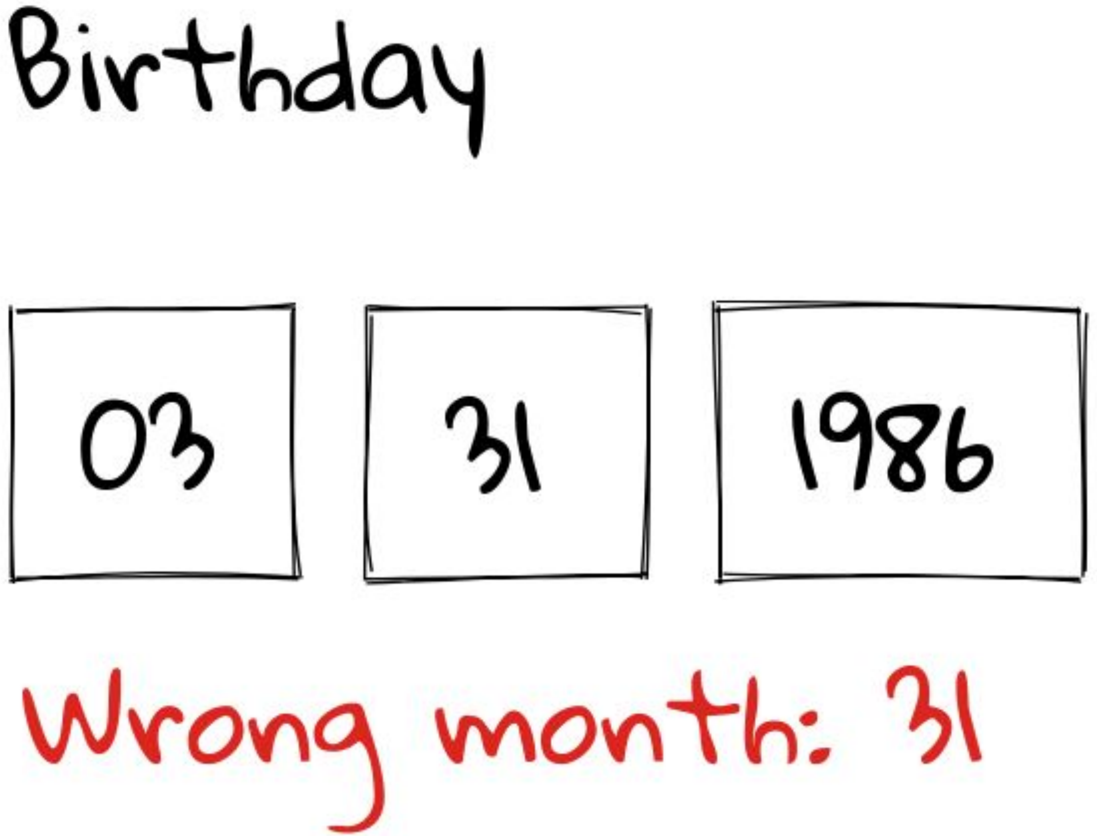
Birthday

31	03	1986

Wrong month: 31

Birthday

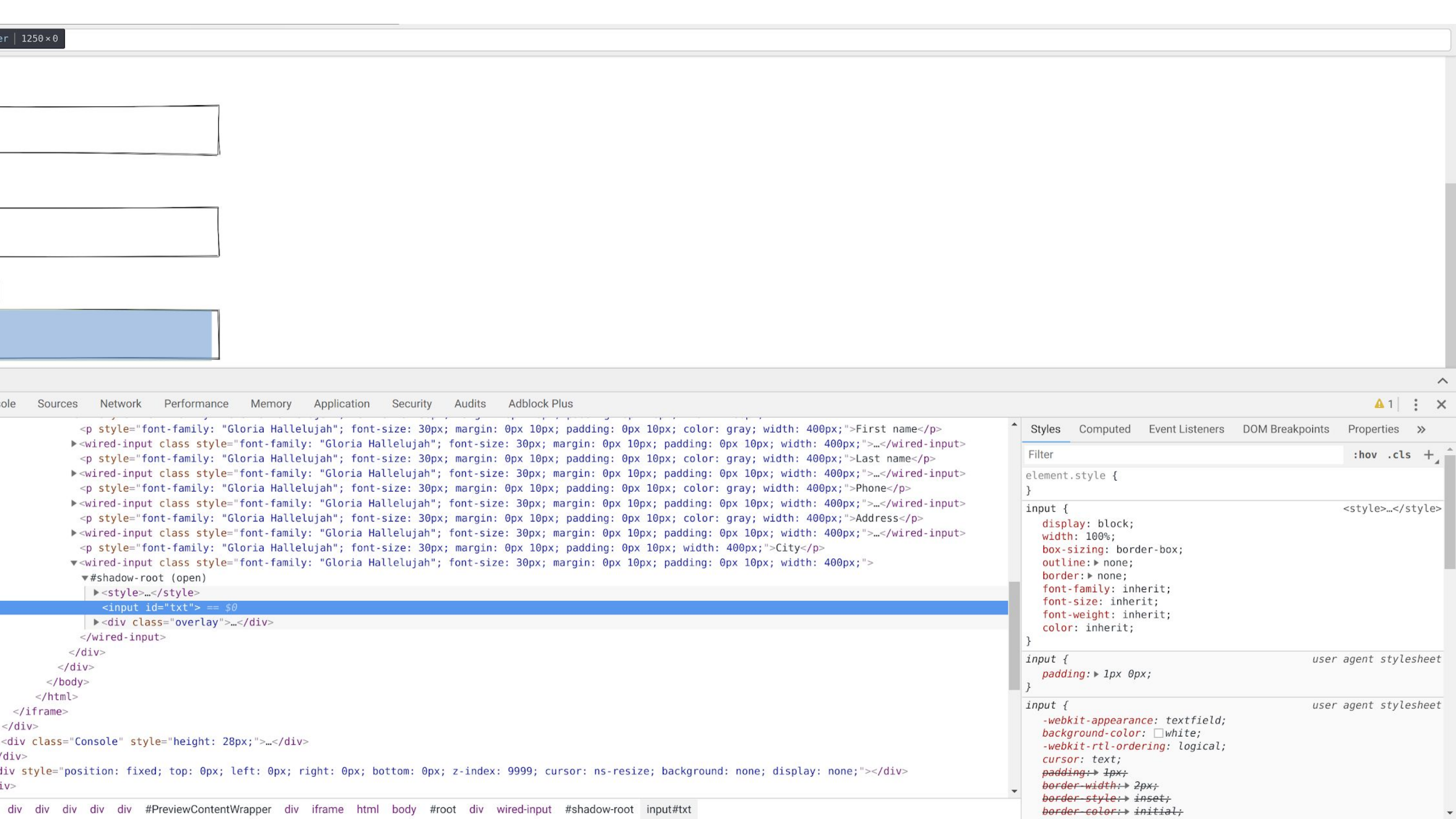
03	31	1986



Birthday

03	31	1986

Wrong month: 31



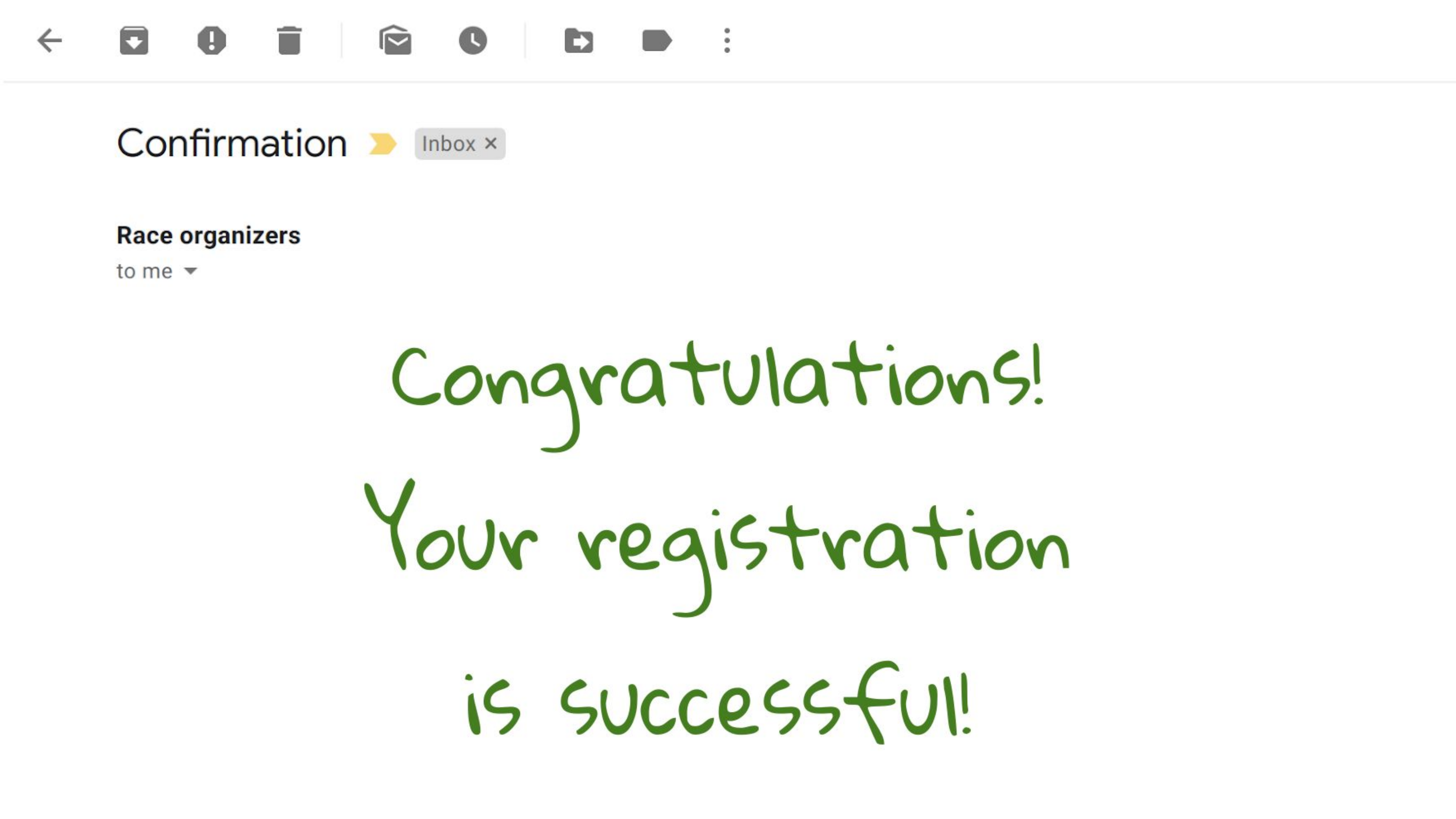
```
    <p style="font-family: "Gloria Hallelujah"; font-size: 30px; margin: 0px 10px; padding: 0px 10px; color: gray; width: 400px;">First name</p>
  ▶<wired-input class style="font-family: "Gloria Hallelujah"; font-size: 30px; margin: 0px 10px; padding: 0px 10px; width: 400px;">…</wired-input>
    <p style="font-family: "Gloria Hallelujah"; font-size: 30px; margin: 0px 10px; padding: 0px 10px; color: gray; width: 400px;">Last name</p>
  ▶<wired-input class style="font-family: "Gloria Hallelujah"; font-size: 30px; margin: 0px 10px; padding: 0px 10px; width: 400px;">…</wired-input>
    <p style="font-family: "Gloria Hallelujah"; font-size: 30px; margin: 0px 10px; padding: 0px 10px; color: gray; width: 400px;">Phone</p>
  ▶<wired-input class style="font-family: "Gloria Hallelujah"; font-size: 30px; margin: 0px 10px; padding: 0px 10px; width: 400px;">…</wired-input>
    <p style="font-family: "Gloria Hallelujah"; font-size: 30px; margin: 0px 10px; padding: 0px 10px; color: gray; width: 400px;">Address</p>
  ▶<wired-input class style="font-family: "Gloria Hallelujah"; font-size: 30px; margin: 0px 10px; padding: 0px 10px; width: 400px;">…</wired-input>
    <p style="font-family: "Gloria Hallelujah"; font-size: 30px; margin: 0px 10px; padding: 0px 10px; width: 400px;">City</p>
  ▼<wired-input class style="font-family: "Gloria Hallelujah"; font-size: 30px; margin: 0px 10px; padding: 0px 10px; width: 400px;">
     ▼#shadow-root (open)
       ▶<style>…</style>
        <input id="txt"> == $0
       ▶<div class="overlay">…</div>
    </wired-input>
   </div>
  </div>
 </body>
</html>
</iframe>
</div>
<div class="Console" style="height: 28px;">…</div>
/div>
div style="position: fixed; top: 0px; left: 0px; right: 0px; bottom: 0px; z-index: 9999; cursor: ns-resize; background: none; display: none;"></div>
iv>
```

```
div  div  div  div  div  #PreviewContentWrapper  div  iframe  html  body  #root  div  wired-input  #shadow-root  input#txt
```

```
element.style {
}
input {                                   <style>…</style>
  display: block;
  width: 100%;
  box-sizing: border-box;
  outline: ▶ none;
  border: ▶ none;
  font-family: inherit;
  font-size: inherit;
  font-weight: inherit;
  color: inherit;
}
input {                                   user agent stylesheet
  padding: ▶ 1px 0px;
}
input {                                   user agent stylesheet
  -webkit-appearance: textfield;
  background-color: white;
  -webkit-rtl-ordering: logical;
  cursor: text;
  padding: ▶ 1px;
  border-width: ▶ 2px;
  border-style: ▶ inset;
  border-color: ▶ initial;
```

Birthday

31	03	1986



Confirmation Inbox ×

Race organizers

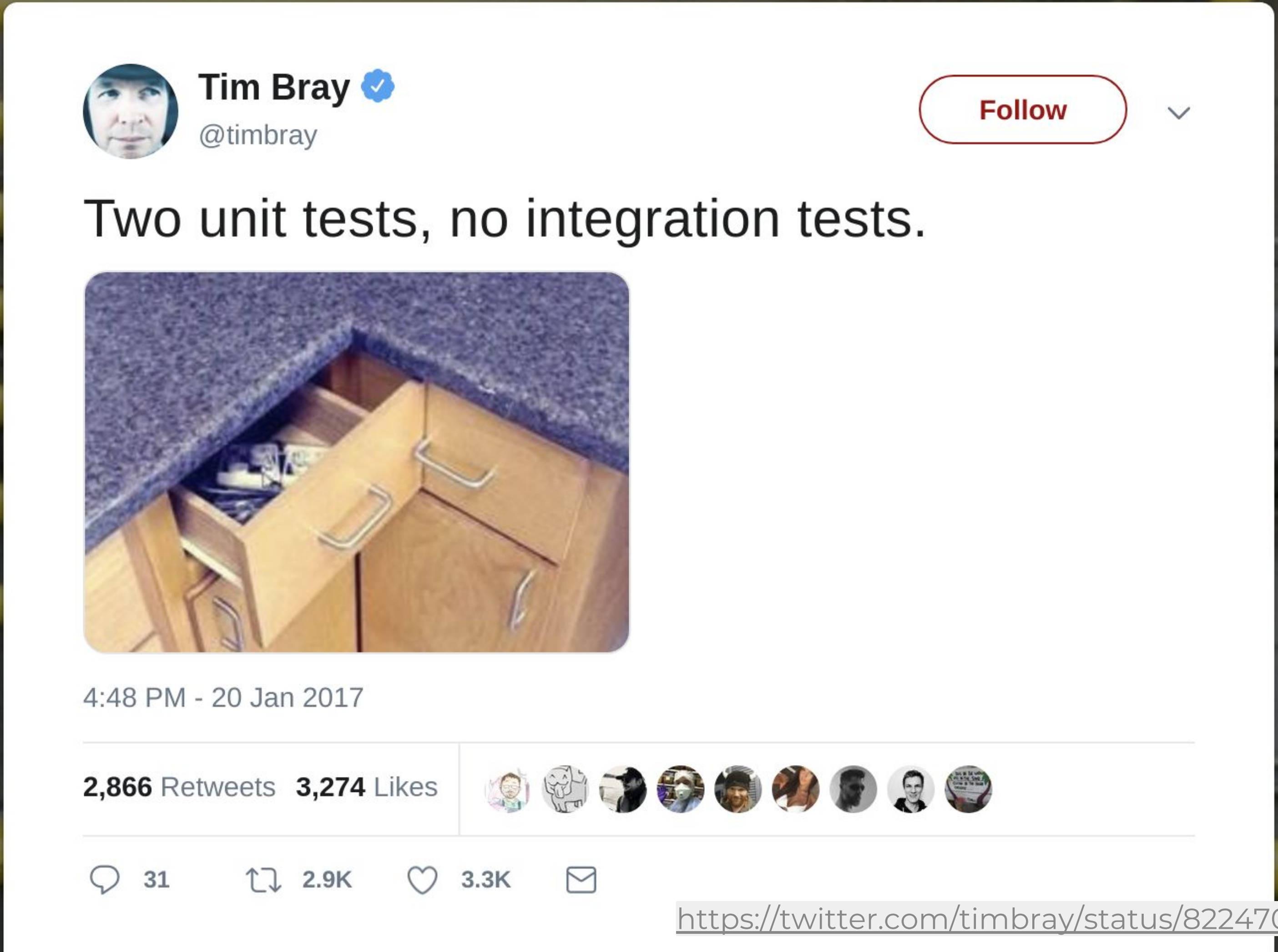
to me

Congratulations!

Your registration

is successful!

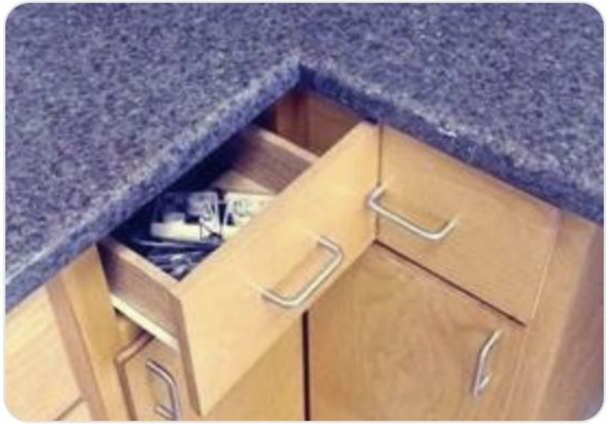
https://imgflip.com/i/2kdpb9



Tim Bray
@timbray

Follow

Two unit tests, no integration tests.



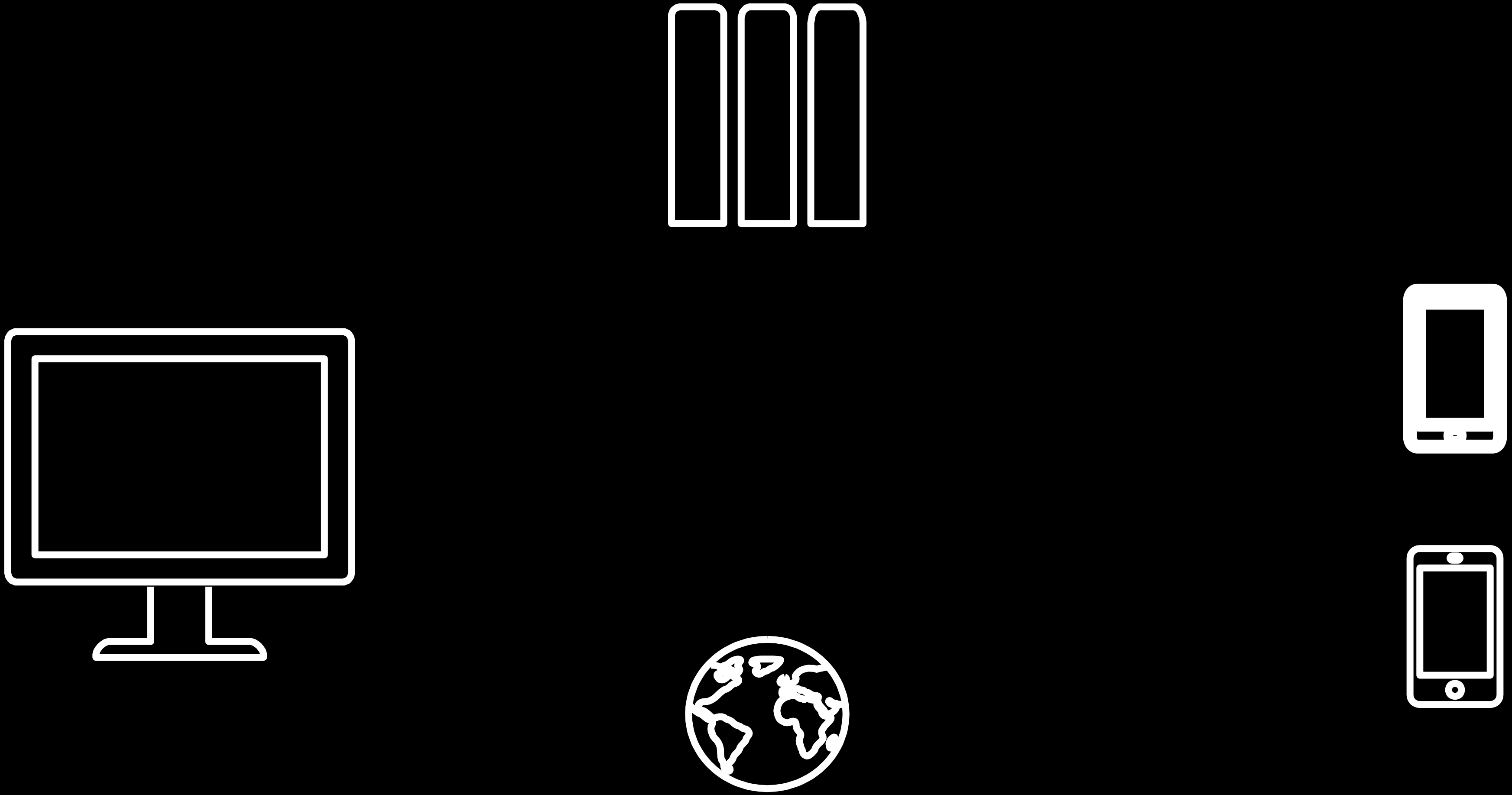
4:48 PM - 20 Jan 2017

2,866 Retweets **3,274** Likes

31 2.9K 3.3K

https://twitter.com/timbray/status/822470746773409794

Modern applications



C
C++
C#
Objective-C
Swift

Java
Python
Ruby

JavaScript
TypeScript

Java

Objective-C
Swift

compiled vs. interpreted

compiled vs. interpreted

static vs. dynamic typing

compiled vs. interpreted

static vs. dynamic typing

manual vs. automatic memory management

C
C++
C#
Objective-C
Swift

Java
Python
Ruby

JavaScript
TypeScript

Java

Objective-C
Swift

~~C~~
~~C++~~
~~C#~~
~~Objective-C~~
~~Swift~~

~~Java~~
~~Python~~
~~Ruby~~

~~JavaScript~~
~~TypeScript~~

~~Java~~

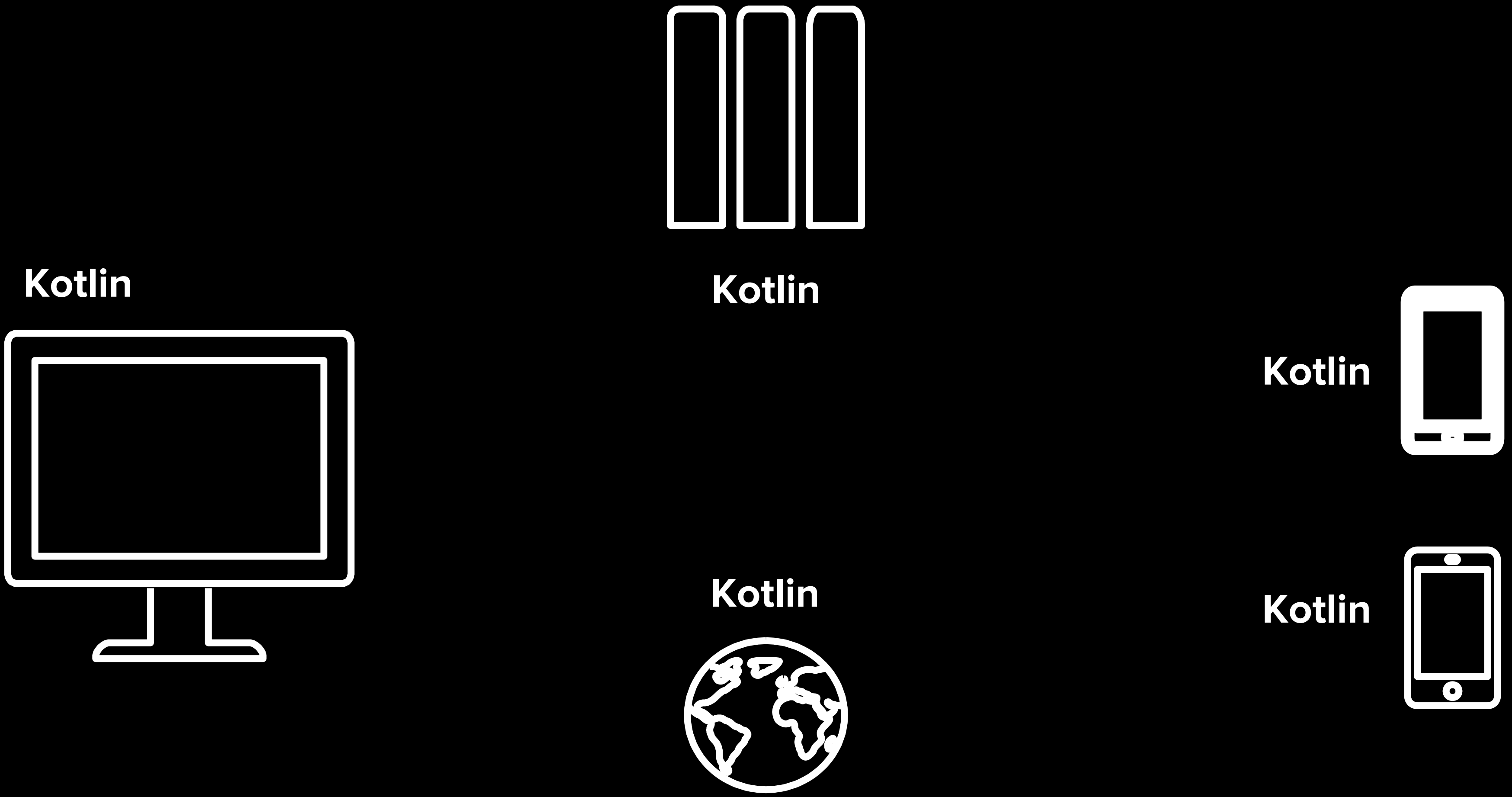
~~Objective-C~~
~~Swift~~

Kotlin

Kotlin

JS

10110
01010
10101


Kotlin
Kotlin
Kotlin
Kotlin
Kotlin

Kotlin/Native

Kotlin/JVM

Kotlin/JVM

Kotlin/JS

Kotlin/Native

Using the same language across all platforms

All team members speak the same language

Using the same language across all platforms

All team members speak the same language

Simplified full-stack development

Using the same language across all platforms

All team members speak the same language

Simplified full-stack development

Single team works on apps for all platforms

Code sharing

Code sharing

Share data structures

Code sharing

Share data structures

Share business logic

Code sharing

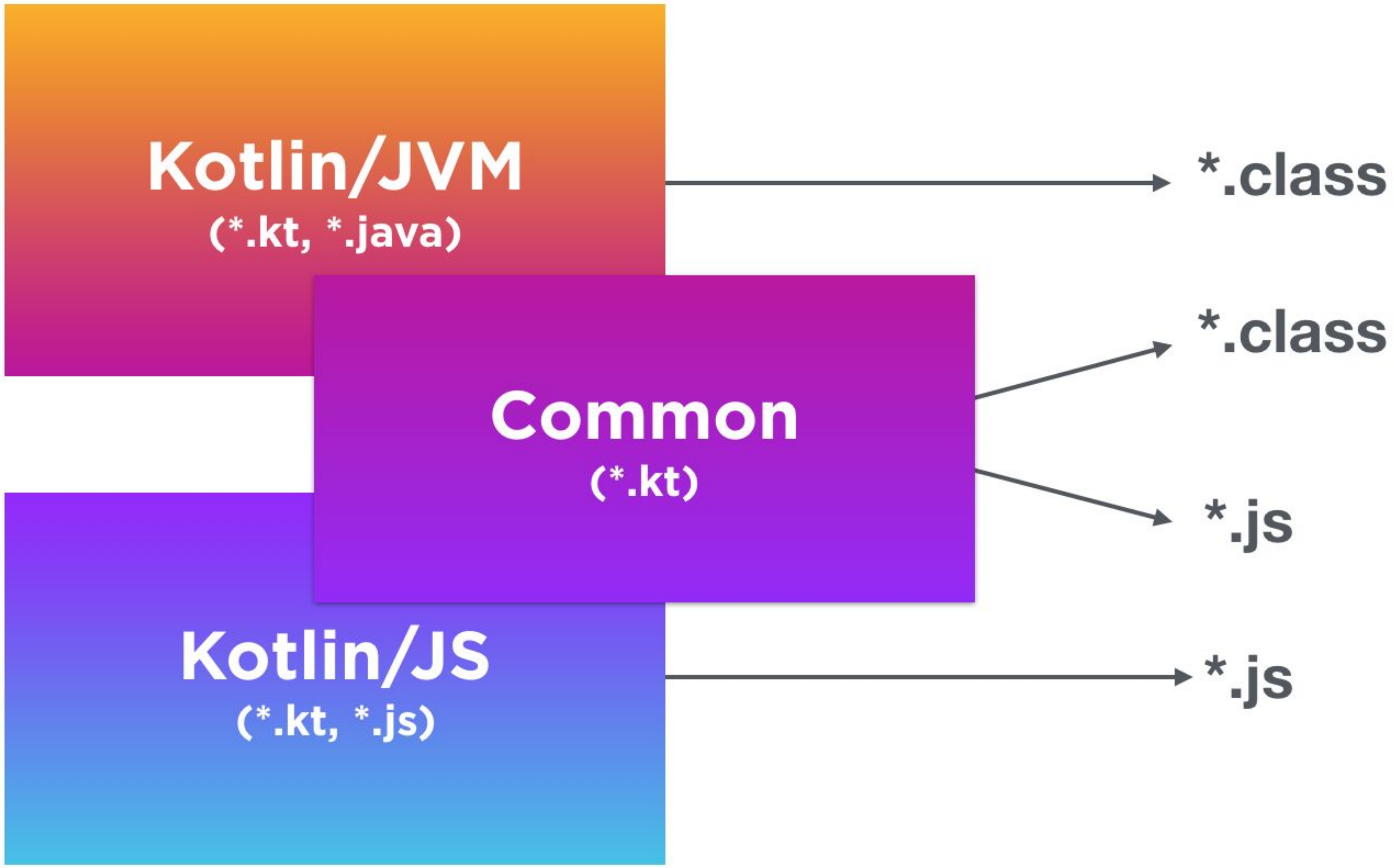
Share data structures

Share business logic

Share tests!

Multiplatform projects in Kotlin

Still experimental


Kotlin/JVM
(*.kt, *.java)
*.class
Common
(*.kt)
*.class
*.js
Kotlin/JS
(*.kt, *.js)
*.js

Kotlin

Common code

```
fun validate(day: Int, month: Int, year: Int): Boolean {
}
```

Common code

```kotlin
fun validate(day: Int, month: Int, year: Int): Boolean {
  return month in 1..12
}
```

Common code

```kotlin
fun validate(day: Int, month: Int, year: Int): Boolean {
  return Date(year, month, day).isValid()
}
```

Common code

```kotlin
fun validate(day: Int, month: Int, year: Int): Boolean {
  return Date(year, month, day).isValid()
}

class Date(day: Int, month: Int, year: Int) {
  fun isValid(): Boolean = ...
}
```

Common code

```kotlin
class Date(day: Int, month: Int, year: Int) {
  fun isValid(): Boolean = ...
}
```

Interfaces

```
interface Date {
  fun isValid(): Boolean
}
```

Kotlin

Interfaces

```
interface Date {
  fun isValid(): Boolean
}

class DateJvm    : Date { override fun isValid() = true }
class DateJs     : Date { override fun isValid() = true }
class DateNative : Date { override fun isValid() = true }
```

Kotlin

Interfaces

```kotlin
interface Date {
  fun isValid(): Boolean
}

object DateFactory {
  fun createDate(day: Int, month: Int, year: Int) = ...
}
```

expect

```
expect class Date(day: Int, month: Int, year: Int) {
  fun isValid(): Boolean
}
```

expect limitations

```
expect class Date(val day: Int, month: Int, year: Int) {
  fun isValid(): Boolean
}
```

expect limitations

```
expect class Date(~~val~~ day: Int, month: Int, year: Int) {
  fun isValid(): Boolean
}
```

Kotlin

expect limitations

```
expect class Date(day: Int, month: Int, year: Int) {
    val day: Int
    val month: Int
    val year: Int
    fun isValid(): Boolean
}
```

expect limitations

```
expect class Date(day: Int, month: Int, year: Int) {
    private val day: Int
    private val month: Int
    private val year: Int
    fun isValid(): Boolean
}
```

expect limitations

```
expect class Date(day: Int, month: Int, year: Int) {
  fun isValid(): Boolean {
    return true
  }
}
```

expect limitations

```
expect class Date(day: Int, month: Int, year: Int) {
  fun isValid(): Boolean ~~{
    return true
  }~~
}
```

expect limitations

```kotlin
expect class Date(day: Int, month: Int, year: Int) {
}

fun Date.isValid(): Boolean {
  return true
}
```

actual

```
actual class Date
    actual constructor(private val day: Int,
                        private val month: Int, private val year: Int) {

    actual fun isValid() = ...
}
```

actual

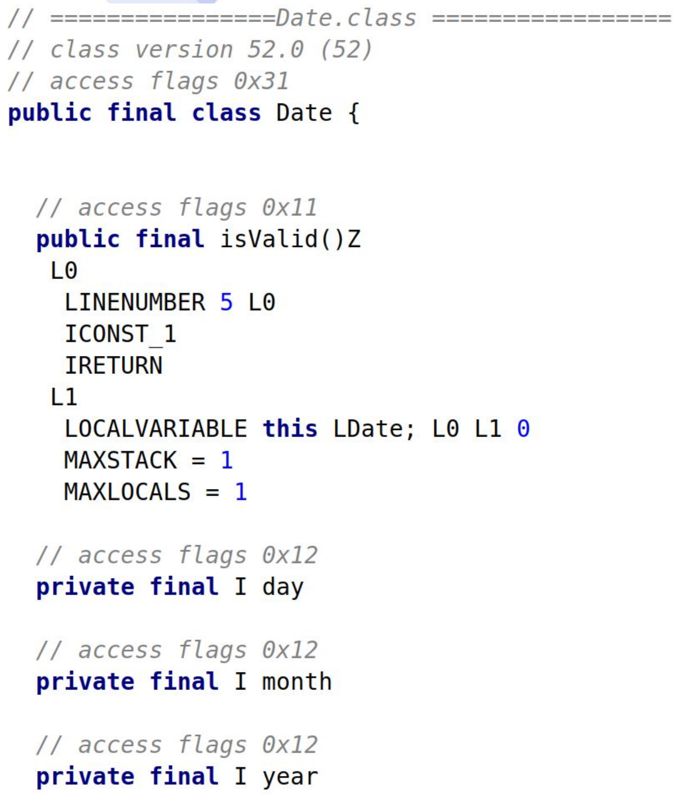
```
actual class Date
  actual constructor(private val day: Int,
          private val month: Int, private val year: Int) {

  actual fun isValid() = true
}
```

Kotlin

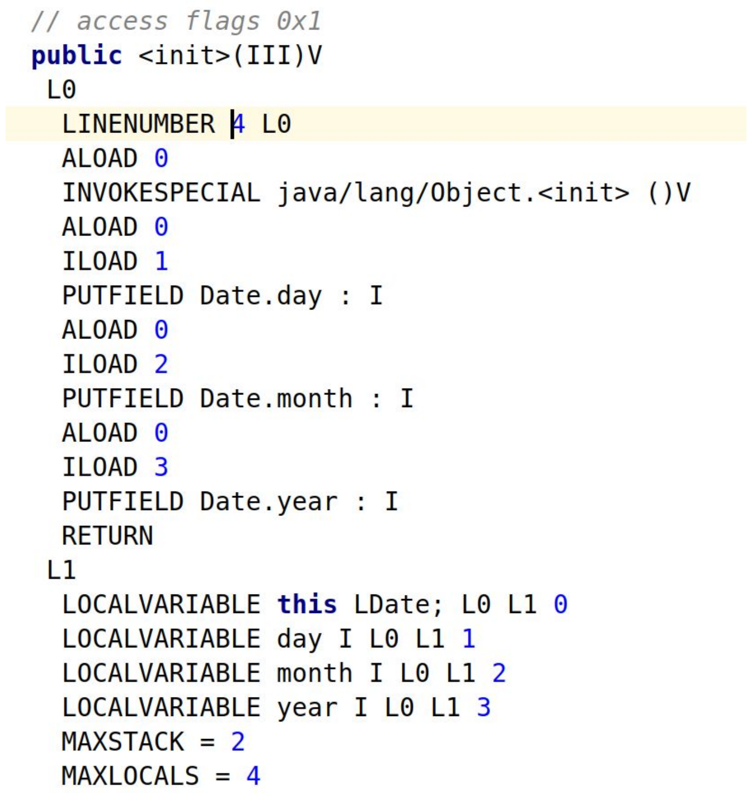
All targets

```
actual class Date // JVM
actual class Date // JS
actual class Date // Native
```

No overhead



```
// ================Date.class =================
// class version 52.0 (52)
// access flags 0x31
public final class Date {


  // access flags 0x11
  public final isValid()Z
   L0
    LINENUMBER 5 L0
    ICONST_1
    IRETURN
   L1
    LOCALVARIABLE this LDate; L0 L1 0
    MAXSTACK = 1
    MAXLOCALS = 1

  // access flags 0x12
  private final I day

  // access flags 0x12
  private final I month

  // access flags 0x12
  private final I year
```



```
// access flags 0x1
public <init>(III)V
 L0
  LINENUMBER 4 L0
  ALOAD 0
  INVOKESPECIAL java/lang/Object.<init> ()V
  ALOAD 0
  ILOAD 1
  PUTFIELD Date.day : I
  ALOAD 0
  ILOAD 2
  PUTFIELD Date.month : I
  ALOAD 0
  ILOAD 3
  PUTFIELD Date.year : I
  RETURN
 L1
  LOCALVARIABLE this LDate; L0 L1 0
  LOCALVARIABLE day I L0 L1 1
  LOCALVARIABLE month I L0 L1 2
  LOCALVARIABLE year I L0 L1 3
  MAXSTACK = 2
  MAXLOCALS = 4
```

Existing actual class

```kotlin
expect class LocalDate {
  fun lengthOfYear(): Int
}
```

typealias

```
expect class LocalDate {
  fun lengthOfYear(): Int
}

// JVM
actual typealias LocalDate = java.time.LocalDate
```

Kotlin

Test typealias

```
expect annotation class Test

actual typealias Test = org.junit.Test
```

Code structure

build.gradle

```
apply plugin: 'kotlin-multiplatform'
```

build.gradle

```
apply plugin: 'kotlin-multiplatform'
kotlin {
    targets {




    }
}
```

build.gradle

```
apply plugin: 'kotlin-multiplatform'
kotlin {
   targets {
       fromPreset(presets.jvm, 'jvm')



   }
}
```

build.gradle

```
apply plugin: 'kotlin-multiplatform'
kotlin {
   targets {
       fromPreset(presets.jvm, 'jvm')
       fromPreset(presets.js, 'js')


   }
}
```

build.gradle

```
apply plugin: 'kotlin-multiplatform'
kotlin {
   targets {
       fromPreset(presets.jvm, 'jvm')
       fromPreset(presets.js, 'js')
       fromPreset(presets.linuxX64, 'linux')
   }
}
```

build.gradle

```
apply plugin: 'kotlin-multiplatform'
kotlin {
   targets {
       fromPreset(presets.jvm)
       fromPreset(presets.js)
       fromPreset(presets.linuxX64, 'linux')
   }
}
```

build.gradle

```
apply plugin: 'kotlin-multiplatform'
kotlin {
    targets {...}
    sourceSets {
    }
}
```

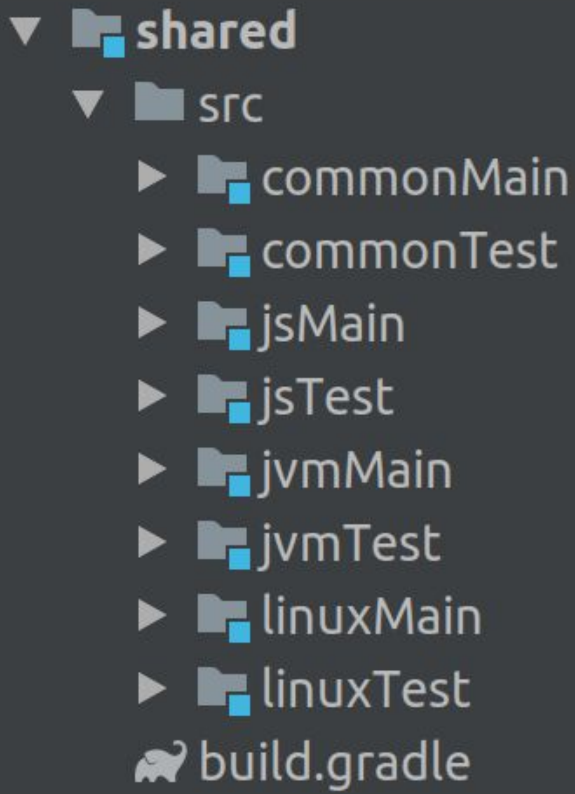
build.gradle

```
apply plugin: 'kotlin-multiplatform'
kotlin {
    targets {...}
    sourceSets {
        commonMain { }
        commonTest { }
    }
}
```

build.gradle

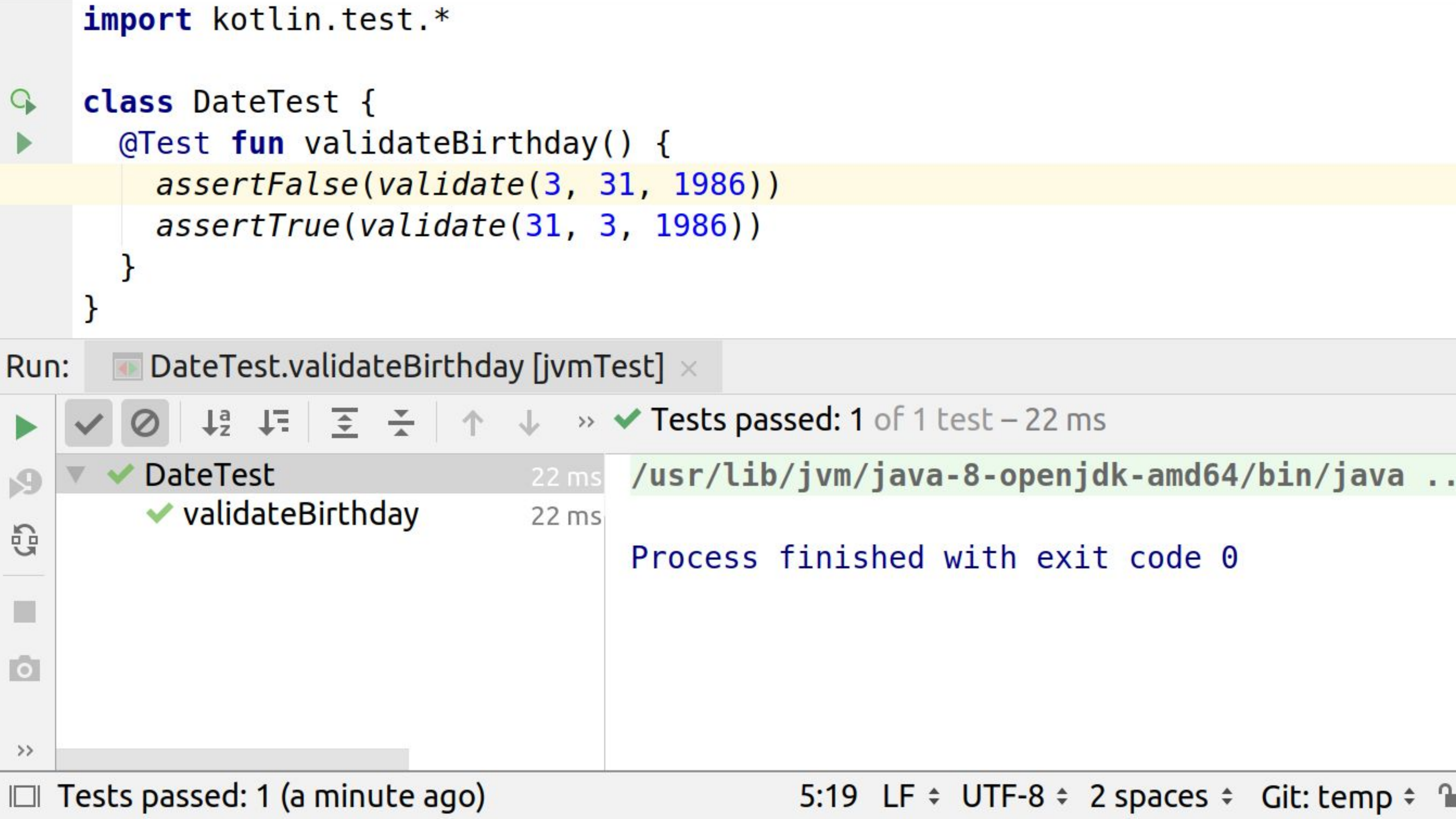
```
sourceSets {
    commonMain { }
    commonTest { }
    jvmMain { }
    jvmTest { }
    jsMain { }
    jsTest { }
    linuxMain { }
    linuxTest { }
}
```

Project structure



```
▼ shared
  ▼ src
    ▶ commonMain
    ▶ commonTest
    ▶ jsMain
    ▶ jsTest
    ▶ jvmMain
    ▶ jvmTest
    ▶ linuxMain
    ▶ linuxTest
  build.gradle
```

Testing



```kotlin
import kotlin.test.*

class DateTest {
  @Test fun validateBirthday() {
    assertFalse(validate(3, 31, 1986))
    assertTrue(validate(31, 3, 1986))
  }
}
```

Run:
DateTest.validateBirthday [jvmTest]
Tests passed: 1 of 1 test – 22 ms
DateTest 22 ms
validateBirthday 22 ms

```
/usr/lib/jvm/java-8-openjdk-amd64/bin/java ..

Process finished with exit code 0
```

Tests passed: 1 (a minute ago)
5:19 LF UTF-8 2 spaces Git: temp

```
$ ./gradlew :shared:linuxTest
> Configure project :frontend
> Configure project :shared
> Task :shared:linuxTest
[==========] Running 1 tests from 1 test cases.
[----------] Global test environment set-up.
[----------] 1 tests from DateTest
[ RUN      ] DateTest.validateBirthday
[       OK ] DateTest.validateBirthday (0 ms)
[----------] 1 tests from DateTest (0 ms total)

[----------] Global test environment tear-down
[==========] 1 tests from 1 test cases ran. (0 ms total)
[  PASSED  ] 1 tests.

BUILD SUCCESSFUL in 14s
3 actionable tasks: 3 executed
```

Kotlin

build.gradle

```
commonMain {
  dependencies {
    implementation 'org.jetbrains.kotlin:kotlin-stdlib-common'
  }
}
commonTest {
  dependencies {
    implementation 'org.jetbrains.kotlin:kotlin-test-common'
    implementation 'org.jetbrains.kotlin:kotlin-test-annotations-common'
  }
}
```

Kotlin

build.gradle

```
jvmMain {
  dependencies {
    implementation 'org.jetbrains.kotlin:kotlin-stdlib-jdk8'
   }
}
jvmTest {
  dependencies {
    implementation 'org.jetbrains.kotlin:kotlin-test'
    implementation 'org.jetbrains.kotlin:kotlin-test-junit'
  }
}
```

Kotlin

build.gradle

```
jsMain {
  dependencies {
    implementation 'org.jetbrains.kotlin:kotlin-stdlib-js'
  }
}
jsTest {
  dependencies {
    implementation 'org.jetbrains.kotlin:kotlin-test'
    implementation 'org.jetbrains.kotlin:kotlin-test-js'
  }
}
```

Project dependencies

```
dependencies {
  implementation project(':shared')
}
```

Multiplatform libraries

kotlin.test

kotlin.test

kotlinx.coroutines

kotlin.test

kotlinx.coroutines

kotlinx.serialization

Write your own library!

Publishing

build.gradle

```
apply plugin: 'maven-publish'
```

Console

```
$ ./gradlew publishToMavenLocal
```

Use it

Date/JVM

```kotlin
actual class Date {
  actual fun isValid(): Boolean {
  }
}
```

Date/JVM

```kotlin
actual class Date actual constructor(day: Int, month: Int,year:Int){
  actual fun isValid(): Boolean {
  }
}
```

Kotlin

Date/JVM

```
actual class Date actual constructor(private val day: Int, private
 val month: Int, private val year: Int) {
  actual fun isValid(): Boolean {
  }
}
```

Date/JVM

```
actual class Date actual constructor(private val day: Int, private
 val month: Int, private val year: Int) {
  actual fun isValid() = try {
       val calendar = Calendar.getInstance()
       calendar.isLenient = false
       calendar.set(year, month - 1, day)
       calendar.time
       true
     } catch (e: Exception) {
       false
     }
}
```

Date/JS

```
actual class Date actual constructor(private val day: Int,
 private val month: Int, private val year: Int) {
 actual fun isValid() = moment(year, month, day).isValid()
}
```

Date/JS

```
actual class Date actual constructor(private val day: Int,
 private val month: Int, private val year: Int) {
 actual fun isValid() = moment(year, month, day).isValid()
}
external interface Moment {
 fun isValid(): Boolean
}
fun moment(day: Int, month: Int, year: Int): Moment =
 definedExternally
```

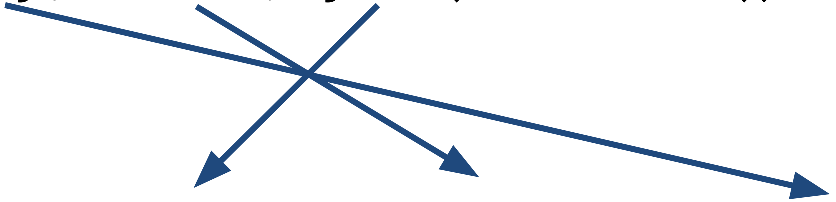
There is a bug still… 😟

Bug

```kotlin
fun validate(day: Int, month: Int, year: Int): Boolean {
  return Date(year, month, day).isValid()
}

expect class Date(year: Int, month: Int, day: Int) {
  fun isValid(): Boolean
}
```

Fixing a bug

```
fun validate(day: Int, month: Int, year: Int): Boolean {
  return Date(day, month, year).isValid()
}
```



```
expect class Date(year: Int, month: Int, day: Int) {
  fun isValid(): Boolean
}
```

Fixing a bug

```kotlin
fun validate(day: Int, month: Int, year: Int): Boolean {
  return Date(day, month, year).isValid()
}

expect class Date(day: Int, month: Int, year: Int) {
  fun isValid(): Boolean
}
```

inline classes

```
inline class Day(val value: Int)
inline class Month(val value: Int)
inline class Year(val value: Int)
```

inline classes

```kotlin
fun validate(day: Day, month: Month, year: Year): Boolean {
  return Date(day, month, year).isValid()
}
expect class Date(day: Day, month: Month, year: Year) {
  fun isValid(): Boolean
}
inline class Day(val value: Int)
inline class Month(val value: Int)
inline class Year(val value: Int)
```

Kotlin

Compile-time type checks

```
@Test fun validateBirthday() {
  assertFalse(validate(Day(3), Month(31), Year(1986)))
  assertTrue(validate(Month(31), Day(3), Year(1986)))
}
```

```
Type mismatch
Required: Day
Found:    Month
```

Recap

Write once, reuse everywhere

Recap

Write once, reuse everywhere

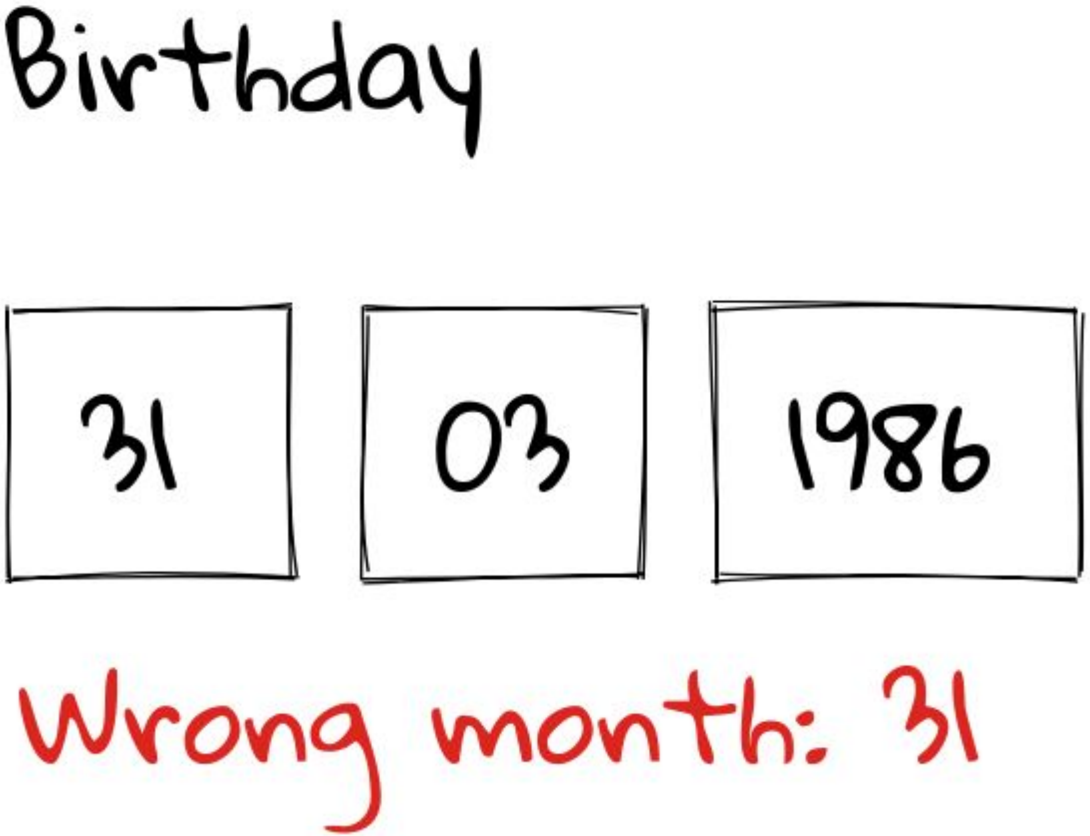
Integrate with platform-specific libraries

Recap

Write once, reuse everywhere

Integrate with platform-specific libraries

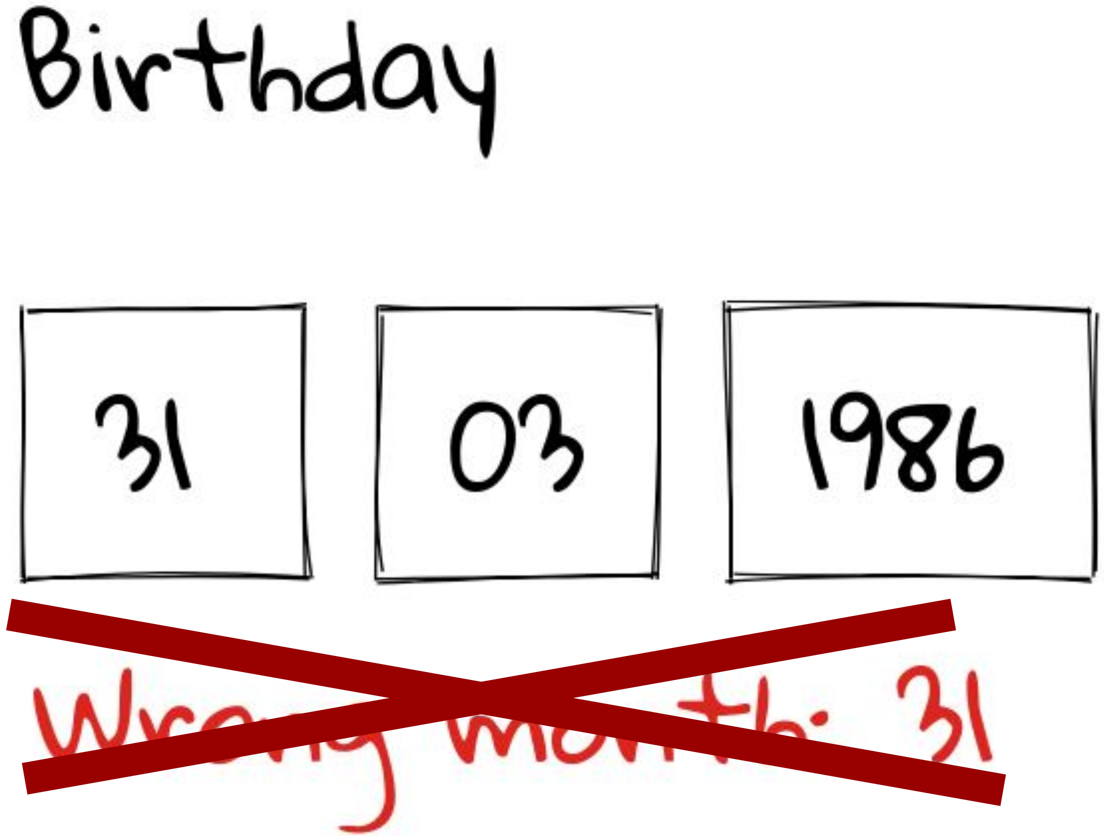
Use all language features on all platforms



Birthday

31	03	1986

Wrong month: 31


Birthday
31
03
1986
~~Wrong month: 31~~

kotl.in/multiplatform

Kotlin

Sample code

github.com/kropp/kotlin-multiplatform-sample

Kotlin

Links

Multiplatform projects documentation

kotl.in/multiplatform

Configuration samples

github.com/h0tk3y/k-new-mpp-samples

Code from this presentation

github.com/kropp/kotlin-multiplatform-sample

Thank you!

Victor Kropp
@kropp
victor.kropp.name