Kotlin for Java Developers

•••

what every java developer should know about kotlin

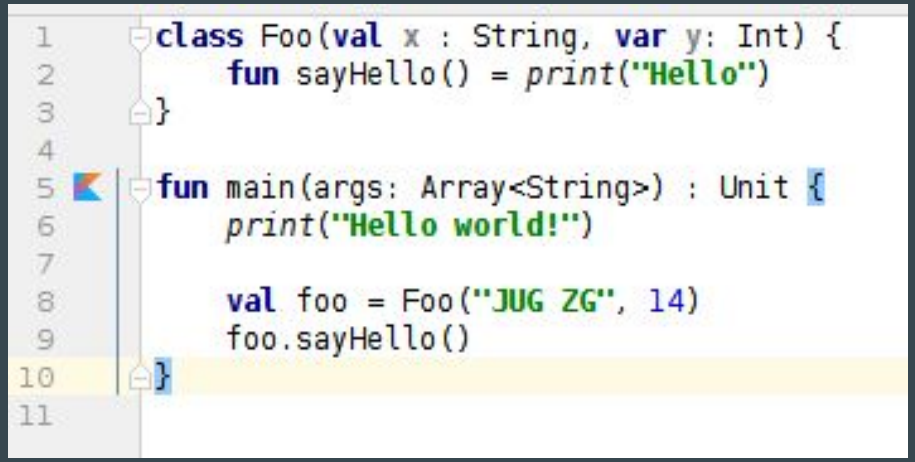
Today I would like to share with you

- Why I care about Kotlin?
- 20 features I love
- 10 features you need to be aware of
- Ecosystem (platforms, tools, documentation, courses)

Next JVM language?

- Statically typed programming language for multi platform applications
  - concise
  - safe
  - interoperable with Java
  - built together with tooling support
  - open source under Apache 2.0 license
- Version 1.0 released in 2015, current version 1.1.2-2 (April 2017)
- Google announced first-class support for Kotlin on Android
- Pivotal will introduce Kotlin support in Spring Framework 5.0
- Easy to learn if you know Java

Kotlin basics



```kotlin
class Foo(val x : String, var y: Int) {
    fun sayHello() = print("Hello")
}

fun main(args: Array<String>) : Unit {
    print("Hello world!")

    val foo = Foo("JUG ZG", 14)
    foo.sayHello()
}
```

Features I love

Extension functions and properties

```
1   import java.io.File
2   import java.math.BigDecimal
3
4   fun Int.toBigDecimal() = BigDecimal.valueOf(this.toLong())
5
6   val Int.bd : BigDecimal
7       get() = BigDecimal.valueOf(this.toLong())
8
9
10  fun String.reverse() = StringBuilder(this).reverse().toString()
11
12
13  fun main(args: Array<String>) {
14      print(1.bd + 2.toBigDecimal())
15
16      print("String to reverse".reverse())
17
18      val lines = File("test").bufferedReader().lines()
19      print(lines)
20  }
21
```

Data classes

```
1    data class Account(val email: String)
```

- equals() / hashCode() pair
- toString() “Account[email=test]”
- componentN() functions in their order of declaration
- copy() function

```
1  import java.util.Objects;
2
3  public class AccountJava {
4
5      private String email;
6
7      public AccountJava(String email) {
8          this.email = email;
9      }
10
11     public String getEmail() {
12         return email;
13     }
14
15     public void setEmail(String email) {
16         this.email = email;
17     }
18
19     @Override
20     public boolean equals(Object o) {
21         if (this == o)
22             return true;
23         if (o == null || getClass() != o.getClass())
24             return false;
25         AccountJava that = (AccountJava) o;
26         return Objects.equals(email, that.email);
27     }
28
29     @Override
30     public int hashCode() {
31         return Objects.hash(email);
32     }
33
34     @Override
35     public String toString() {
36         return "AccountJava{" + "email='" + email + '\'' + '}';
37     }
38 }
39
```

String templates

```
fun main(args: Array<String>) {

    val name = "JUG Zielona Góra!"
    val message = "Hello: $name"
    print(message)

    val s = "abc"
    print("String length is ${if (args.isNotEmpty()) args[0].length else s.length}")
}

```

Null safety

- Types defines nullability
  - Platform types
- Safe calls
- Elvis operator
- !!. operator
- Safe casts

```kotlin
fun main(args: Array<String>) {

    // Non null type
    var a: String = "abc"
    //a = null // compilation error


    // Nullable type
    var b: String? = "abc"
    b = null // ok


    // Safe calls
    val l = if (b != null) b.length else -1
    b?.length


    // Elvis operator
    val account : Account? = Account("email", null)
    print(account?.externalId ?: "Not a number")


    // The !! operator
    b!!.length


    // Safe casts - return null if cast was not successful
    val aInt: Int? = a as? Int
}
```

when

```
fun getScore(score: Int) = when (score) {
    9, 10 -> "Excellent"
    in 6..8 -> "Good"
    4, 5 -> "Ok"
    in 1..3 -> "Fail"
    else -> "Fail"
}

fun whenShowcase(x : Any?) {
    val validNumbers = listOf(21, 22, 23)

    val result = when (x) {
        0, 1 -> "x == 0 or x == 1"
        is String -> x.startsWith("prefix")
        in 1..10 -> "x is in the range"
        in validNumbers -> "x is valid"
        !in 10..20 -> {
            "x is outside the range"
        }
        else -> "Else branch"
    }
    print(result)
}
```

```
public class ScoreSwitch {
    String getScore(int score) {
        String grade;
        switch (score) {
        case 10:
        case 9:
            grade = "Excellent";
            break;
        case 8:
        case 7:
        case 6:
            grade = "Good";
            break;
        case 5:
        case 4:
            grade = "Ok";
            break;
        case 3:
        case 2:
        case 1:
            grade = "Fail";
            break;
        default:
            grade = "Fail";
        }
        return grade;
    }
}
```

Operator overloading

- +, -, *, /, %, ..
  - a + b -> **a.plus(b)**
  - a..b -> **a.rangeTo(b)**
- in, !in
  - **a.contains(b)**
- Indexed access []
  - a[i] -> **a.get(i)**
  - a[i] = b -> **a.set(i, b)**
- Invoke
  - a(i, j) -> **a.invoke(i, j)**
- a == b
  - a?.equals(b) ?: (b === null)
- a > b, a < b, a >= b, a <= b -> **a.compareTo(b)**

Operator overloading (1)

```
3       // + on BigDecimal
4       print(123.bd + 234.bd)
5
6       // []
7       val list = arrayOf(1, 2, 3)
8       list[0] = list[2]
9
10      // in, !in
11      println(4 !in list)
12      println('f' in 'a'..'z')
13
14      // invoke
15      val f = { a: Int, b: Int -> a + b }
16      println(f.invoke(2,3))
17      val f1 = f
18      println(f1(2,3))
19
20      // ==, ===
21      val account1 = Account("test", "foo")
22      val account2 = Account("test", "foo")
23      println(account1 == account2)
24      println(account1 === account2)
25
26      // comparison
27      println("1" > "2")
```

Default and named parameters

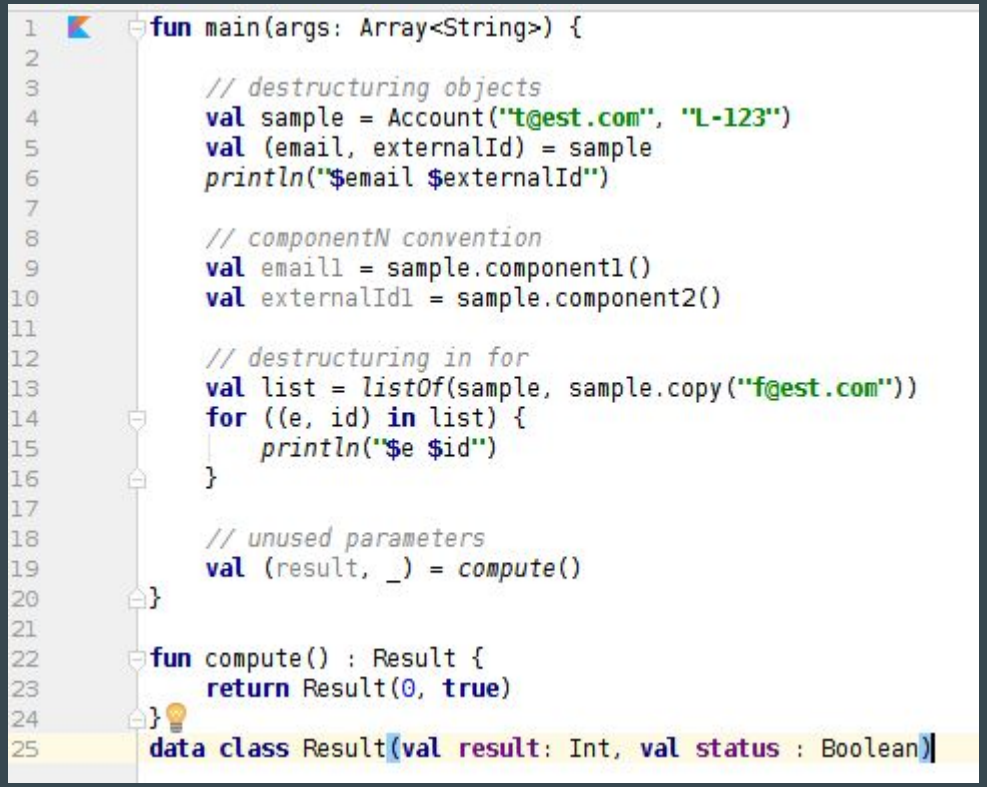
```kotlin
@JvmOverloads
fun List<Any?>.join(separator: String = ", ", prefix: String = "[", postfix: String = "]"): String {
    val sb = StringBuilder()
    sb.append(prefix)
    for ((idx, e) in this.withIndex()) {
        sb.append(e)
        if (idx != this.lastIndex) {
            sb.append(separator)
        }
    }
    sb.append(postfix)
    return sb.toString()
}

fun main(args: Array<String>) {
    val list = listOf(1, 2, 3, 4, 5, 6, 7, 8, 9)
    println(list.join("|", ">", "<"))
    println(list.join(prefix = ">", postfix = "<"))
    println(list.join())
}
```

Smart casts

```
1  fun smartFun(arg: Any) {
2      when (arg) {
3          is Int -> print(arg + 1)
4          is String -> print(arg.length + 1)
5          is IntArray -> print(arg.sum())
6      }
7  }
8
9  fun smartCasts(arg: Any?) {
10     if (arg !is String) return
11     println("$arg is String and its length is ${arg.length}")
12
13     if (arg is CharSequence && arg.length > 4) {
14         println(arg.length)
15     }
16 }
17
18 fun main(args: Array<String>) {
19
20     smartFun(1)
21     smartFun("JUG Zielona Góra")
22     smartFun(intArrayOf(1, 2, 3, 4, 5))
23
24     val x : Int? = null
25     val y = if (x != null) {
26         x + 4
27     } else {
28         0
29     }
30 }
```

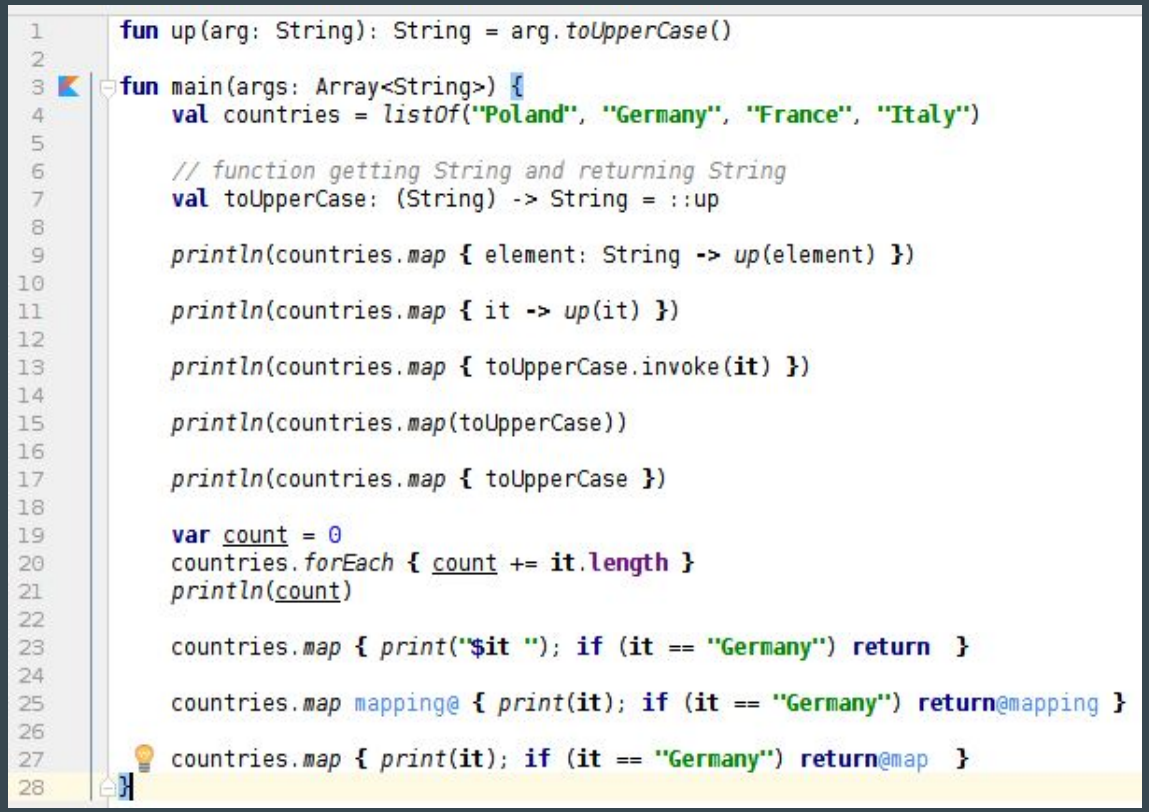
Destructuring objects

- underscore for unused variables (1.1)
- destructuring in lambdas (1.1)



```kotlin
fun main(args: Array<String>) {

    // destructuring objects
    val sample = Account("t@est.com", "L-123")
    val (email, externalId) = sample
    println("$email $externalId")

    // componentN convention
    val email1 = sample.component1()
    val externalId1 = sample.component2()

    // destructuring in for
    val list = listOf(sample, sample.copy("f@est.com"))
    for ((e, id) in list) {
        println("$e $id")
    }

    // unused parameters
    val (result, _) = compute()
}

fun compute() : Result {
    return Result(0, true)
}
data class Result(val result: Int, val status : Boolean)
```

Lambda and closures



```kotlin
fun up(arg: String): String = arg.toUpperCase()

fun main(args: Array<String>) {
    val countries = listOf("Poland", "Germany", "France", "Italy")

    // function getting String and returning String
    val toUpperCase: (String) -> String = ::up

    println(countries.map { element: String -> up(element) })

    println(countries.map { it -> up(it) })

    println(countries.map { toUpperCase.invoke(it) })

    println(countries.map(toUpperCase))

    println(countries.map { toUpperCase })

    var count = 0
    countries.forEach { count += it.length }
    println(count)

    countries.map { print("$it "); if (it == "Germany") return  }

    countries.map mapping@ { print(it); if (it == "Germany") return@mapping }

    countries.map { print(it); if (it == "Germany") return@map  }
}
```

Expressions and statements

- if and when are expressions, not statements
  - val length = if (a is String) a.length else -1
  - val action = when (test) {
    in 0..5 -> OPEN
    else -> CLOSE
    }
- assignment is a statement, not an expression
  - if (a = b) does not compile
  - while ((line = bufferedReader.readLine()) != null) does not compile

Packages and source code structure

- packages
- import allows to import classes, functions, *
- type aliases
- multiple classes in one file
- arbitrary file names
- arbitrary directory structure
- visibility modifiers: private, protected, internal, public

Other languages have all these features

- Null safety
- No checked exceptions
- Extension functions
- Function types and lambdas
- Default and named parameters
- Properties
- Operator overloading
- Smart casts
- Data classes
- Immutable collections
- Enhanced switch-case
- String templates
- Ranges
- Infix notation
- Inline functions
- Coroutines (async/await)
- Great standard library
- Sealed classes
- Delegated and lazy properties
- Class delegation
- Singletons
- Nested functions
- Object decomposition
- Top-level functions
- Reified generics
- Raw strings
- 100% interoperable with Java 6
- And more...

Compile and run with Java code

- you can mix Java and Kotlin code in one project
- experiment with new language without breaking or rewriting the whole application
- small memory footprint of the Kotlin standard library

Understand decisions

What you need to know

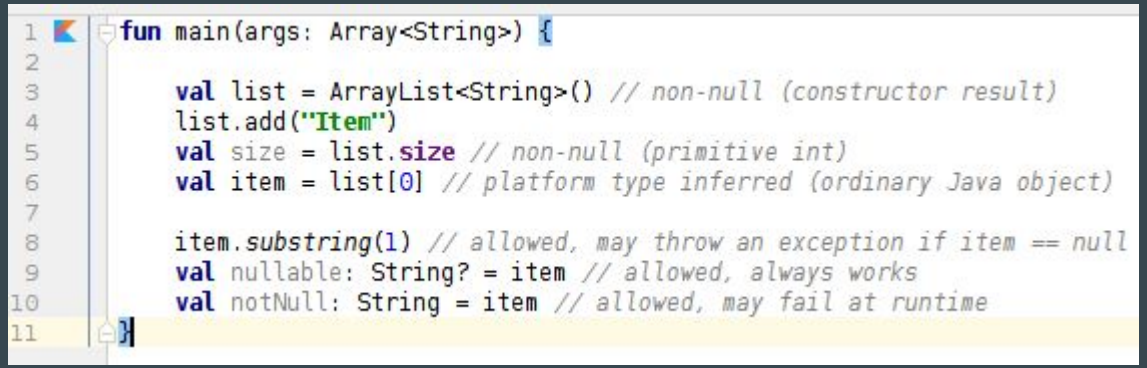
- final by default
- platform types and nullability
- no primitives, no implicit widening conversions for numbers
- bytecode
- function names - conventions
- standard library

Final by default

- all classes, methods are final by default
  - tedious opening via ‘open’ keyword
  - interference with AOP (CGLIB), workarounds as compiler plugins ‘kotlin-spring’, ‘all-open’
- ‘override’ is a required keyword, not an annotation
- designing for inheritance

Platform types and nullability (!)

- any reference in Java may be null
- types of Java declarations are called platform types
- can be assigned to nullable or non-null type
- compiler, tools refers to them using as **T!** which means **T** ot **T?**
- nullability annotations (JSR-305, Android, Lombok, JetBrains, Eclipse)



```
fun main(args: Array<String>) {

    val list = ArrayList<String>() // non-null (constructor result)
    list.add("Item")
    val size = list.size // non-null (primitive int)
    val item = list[0] // platform type inferred (ordinary Java object)

    item.substring(1) // allowed, may throw an exception if item == null
    val nullable: String? = item // allowed, always works
    val notNull: String = item // allowed, may fail at runtime
}
```

Bytecode generation

- kotlinc generates Java 6 or Java 8 bytecode
- on JVM lambdas does not use ‘invokedynamic’
- https://www.slideshare.net/intelliyole/kotlin-bytecode-generation-and-runtime-performance

Function naming conventions

- a() -> invoke
- [] -> a.set, a.get
- ==, != -> equals
- for (element in container) -> uses iterator()
- in -> a.contains(b), !in
- infix notation 1.shl(2) -> 1 shl 2

Standard library

- kotlin-runtime and kotlin-stdlib -> kotlin-stdlib
  - < 1MB jar (JVM)
- Kotlin classes and extension functions to Java classes
  - kotlin
  - kotlin.collections
  - kotlin.comparisons
  - kotlin.concurrent
  - kotlin.io
  - kotlin.streams
  - kotlin.text
- kotlin.jvm
- kotlin.js

Platforms and tooling

Platforms and tooling

- JVM
  a. Java 6 and 8
- Android
- JavaScript (ES5.1)
  a. compatible with module systems like AMD, CommonJS
- native (LLVM)
  a. LLVM is used to compile Kotlin into native code
  b. technology preview for iOS, linux, MAC, (windows in the work)
- IntelliJ IDEA (Java to Kotlin converter), Eclipse
- Gradle, Maven, Ant

Where to start?

- Try online https://try.kotlinlang.org/
- Kotlin is Awesome! https://kotlin.link/
- This presentation http://github.com/tkleszczynski/jug-zgora-kotlin/Kotlin-jug.pdf
- And code examples http://github.com/tkleszczynski/jug-zgora-kotlin

What will be your next JVM language?

...

https://en.wikipedia.org/wiki/List_of_JVM_languages