KOTLIN

LEOMINSTER CODE MEETUP

Will Winder

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willwinder.com

STATICALLY TYPED PROGRAMMING LANGUAGE FOR MODERN MULTIPLATFORM APPLICATIONS

100% INTEROPERABLE WITH JAVA™ AND ANDROID™

kotlinlang.org

KOTLIN IS JUST PLAIN FUN. MAYBE IT'S SUBLIMINAL ADVERTISING, SINCE THEIR KEYWORD FOR DECLARING METHODS IS FUN. BUT IT'S SOMEHOW TURNED ME FROM A SURLY PROFESSIONAL PROGRAMMER INTO A HOBBYIST AGAIN.

Steve Yegge

ABOUT KOTLIN

- Developed by Jetbrains, maker of great IDEs
- 100% interoperable with Java
- Started in 2010, open sourced February 2012
- 1.0 released February 15, 2016
- "Kotlin" is an island near St. Petersburg
- First class language for Android in 2017

LANGUAGE GOALS

- **General purpose**
- **Statically Typed**
- **Multi-paradigm** - OOP, Functional
- **Multiple Backends** - JVM, Javascript, Native (LLVM)
- **Productivity** - Not a research project
- **Borrow** - Shamelessly from other languages

WHO IS KOTLIN FOR?

- Java developers.
  Generates 100% interoperable byte code, back to Java 6 (2006).
- Web developers.
  Transpile to javascript.
- Windows / iOS developers.
  LLVM backend supports native binaries.
- Developers who write shell scripts!

WHY KOTLIN

Concise

Drastically reduce the amount of boilerplate code.

Safe

Avoid entire classes of errors such as null pointer exceptions.

Interoperable

Leverage existing libraries for the JVM, Android, and the browser.

Tool-friendly

Choose any Java IDE or build from the command line.

HELLO, WORLD!

```
fun main(args: Array<String>) {
    println("Hello, world!")
}
```

VALUES AND IMMUTABILITY

```
val firstName: String = "Will"

val lastName = "Winder"

println("$firstName $lastName")

// values are immutable!
firstName = "Owen"
```

VARIABLES

```
var firstName = "Will"

var lastName = "Winder"

firstName = "Owen"

println("$firstName $lastName")
```

NULL SAFETY

```
var x: Int = null
x --

var y: Int? = null
y --
```

NULL SAFETY

```
// 'String' cannot be null
val nullString1: String = null

// Safe, 'String' cannot be null
nullString1.reversed()

// 'String?' may be null!
val nullString2: String? = null

// Not safe, cannot call a function on a nullable object!
nullString2.reversed()
```

WORKING WITH NULL

```
// Smart casting, the compiler upgrades the
// type to 'String' after the null check.
if (nullString2 != null) nullString2.reversed()

// The compiler also suggests we use '?.' which
// has the same effect.
nullString2?.reversed()?.toUpperCase()
```

WORKING WITH NULL

```
// Illegal assignment, 'result1' cannot be null.
val result1: String = nullString2?.reversed()

// Default assignment in case of a null!
val result2: String = nullString2?.reversed() ?: "default!"

// Or error handling!
val result3: String = nullString2?.reversed() ?: throw Exception("malformed!")
```

NULLABLE PARAMETERS

```
fun someFunction(param1: String?, param2: String): Int {

    println(param1.reversed())

    println(param2.padStart(5, '0'))

    val x: Int? = null

    val y: Int = null

    return null
}
```

FUNCTION SYNTAX

```
fun maximum(first: Int, second: Int): Int {
    if (first > second) {
        return first
    } else {
        return second
    }
}
```

FUNCTION SYNTAX

Function Name

Parameters

Return Value

Compiler Hint

```
fun maximum(first: Int, second: Int): Int {
    if (first > second) {
        return first
    } else {
        return second
    }
}
```

IF IS AN EXPRESSION

```
fun maximum(first: Int, second: Int): Int {
    if (first > second) {
        return first
    } else {
        return second
    }
}
```

```
fun maximum(first: Int, second: Int): Int {
    return if (first > second) {
        first
    } else {
        second
    }
}
```

SINGLE EXPRESSION FUNCTION

```
fun maximum(first: Int, second: Int): Int {
    return if (first > second) {
        first
    } else {
        second
    }
}
```

```
fun maximum(first: Int, second: Int): Int =
    if (first > second) {
        first
    } else {
        second
    }
```

SINGLE EXPRESSION FUNCTION

```
fun maximum(first: Int, second: Int): Int =
    if (first > second) {
        first
    } else {
        second
    }
```

```
fun maximum(first: Int, second: Int) =
        if (first > second) first else second
```

CALLING A FUNCTION

```
fun maximum(first: Int, second: Int) =
    if (first > second) first else second
```

```
fun main(args: Array<String>) {
  println(maximum(1,2))
  println(maximum(first = 1, second = 2))
}
```

Named Parameters

DATA STRUCTURES: LIST

```
val list: List<Int> = listOf(1, 2, 3, 4, 5)

list.filter { it >= 3 }
    .filterNot { it % 2 == 0 }
    .forEach { println("odd numbers >= 3: $it") }
```

```
odd numbers >= 3: 3
odd numbers >= 3: 5
```

DATA STRUCTURES: MUTABLE LIST

```
val mutableList: MutableList<Int> = mutableListOf(0)

(10 downTo 1).forEach { mutableList.add(it) }

(1..5).forEach { index ->
    mutableList.shuffle()
    println("$index. even value: " + mutableList.find { it % 2 == 0 })
}
```

```
1. even value: 0
2. even value: 8
3. even value: 6
4. even value: 8
5. even value: 10
```

DATA STRUCTURES: MAP

```
val map: Map<Int, String> = mapOf(0 to "Zero", 1 to "One")

println("Map value at 1: ${map[1]}")

println("Undefined map value: ${map[2]}")

println("Default map value 1: ${map.getOrDefault(2, "boo")}")
println("Default map value 2: ${map[2] ?: "boo"}")

val mutableMap = mutableMapOf<Int,String>()

mutableMap[0] = "Zero"
```

```
Map value at 1: One
Undefined map value: null
Default map value 1: boo
Default map value 2: boo
```

DATA STRUCTURES: ARRAY

```
val array: Array<Long> = arrayOf(0, 1, 2)
println(array
        .map { it * it }
        .joinToString())
```

```
0, 1, 4
```

DATA STRUCTURES: SET

```
val set: Set<String> = setOf("one", "one", "two")

println("Size of set: ${set.size}")
```

```
Size of set: 2
```

DEFAULT ARGUMENTS

```
fun main(args: Array<String>) {
    /*
    fun <T> Iterable<T>.joinToString(
        separator: CharSequence = ", ",
        prefix: CharSequence = "",
        postfix: CharSequence = "",
        limit: Int = -1,
        truncated: CharSequence = "...",
        transform: (T) -> CharSequence = null
    ): String
    */

    val data = listOf(1, 2, 3, 4)
    println(data.joinToString(", ") { "num($it)" })
    println(data.joinToString(
            separator = ".. ",
            limit = 2,
            truncated = "and many more"))
}
```

```
num(1), num(2), num(3), num(4)
1 2 and many more
```

CLASSES

```
class MyClass(val text: String, private val count: Int) {
    fun repeat() =
            (1..count).fold(StringBuilder()) {
                acc, _ -> acc.append(text)
            }.toString()
}

fun main(args: Array<String>) {
    val myClass = MyClass("Test", 5)
    println("text: " + myClass.text)
    // count is private
    // println("count: " + myClass.count)
    println(myClass.repeat())
}
```

```
text: Test
TestTestTestTestTest
```

BRINGING IT ALL TOGETHER 1

```
fun mightBeNull(str: String): String? =
    if (Random().nextInt() % 2 == 0) str else null

fun dealingWithNull(input: String) {
    (0..10).forEach {
        println(mightBeNull(input)?.toUpperCase() ?: "it was null")
    }
}

fun main(args: Array<String>) {
    dealingWithNull("Leominster Code Meetup")
}
```

```
LEOMINSTER CODE MEETUP
it was null
LEOMINSTER CODE MEETUP
it was null
it was null
LEOMINSTER CODE MEETUP
LEOMINSTER CODE MEETUP
it was null
LEOMINSTER CODE MEETUP
LEOMINSTER CODE MEETUP
LEOMINSTER CODE MEETUP
```

BRINGING IT TOGETHER 2

```
1
2  fun main(args: Array<String>) {
3      // Helper function
4      fun illegalNumber(num: Int) = num == 3
5
6      // Data class
7      data class NumTuple(val num: Int, val name: String? = null)
8
9      val one = NumTuple(1, "one")
10     val two = NumTuple(2)
11
12     val listOfLists: List<List<NumTuple>> =
13         listOf(
14             listOf(two, NumTuple(4, "four")),
15             listOf(one, NumTuple(3, "three"))
16         )
17
18     listOfLists
19         .flatMap { it }
20         .sortedBy { it.num }
21         .filterNot { illegalNumber(it.num) }
22         .forEach { println(it.name ?: it.num) }
23 }
24
```

```
one
2
four
```

JAVASCRIPT

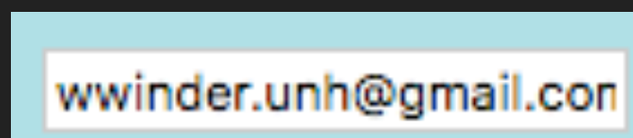
```
<!DOCTYPE html>
<html lang="en">
<body>

<input type="text" name="email" id="email"/>

<!-- kotlin artifacts -->
<script type="text/javascript" src="out/produ
<script type="text/javascript" src="out/produ
</body>
</html>
```

```
import org.w3c.dom.HTMLInputElement
import kotlin.browser.document

fun main(args: Array<String>) {
    document.body?.style?.backgroundColor = "powderblue"
    val email = document.getElementById("email") as HTMLInputElement
    email.value = "wwinder.unh@gmail.com"
}
```



WEBSERVER CREATE/READ (JAVALIN)

```
/opt/JavalinTest$ curl -s -X GET http://localhost:7000/user/2 | json_pp
{
   "id" : 2,
   "name" : "corey",
   "sign" : "Virgo"
}
/opt/JavalinTest$ curl -X PUT -d '{"id":3,"name":"ben","sign":"Aquarius"}' \
> http://localhost:7000/user/create -w "\n"
User created successfully: User(id=3, name=ben, sign=Aquarius)
/opt/JavalinTest$
/opt/JavalinTest$ curl -s -X GET http://localhost:7000/user/3 | json_pp
{
   "sign" : "Aquarius",
   "name" : "ben",
   "id" : 3
}
```

```kotlin
import io.javalin.Javalin

data class User(val id: Int, val name: String, val sign: String)

fun main(args: Array<String>) {
    val data = mutableMapOf(
        1 to User(1, "will", "Aries"),
        2 to User(2, "corey", "Virgo")
    )

    // Create a server and start it.
    val app = Javalin.create().start(7000)

    // Endpoint handlers
    app.get("/") { ctx -> ctx.result("Hello World") }

    app.get("/user/:id") { ctx ->
        val id = ctx.pathParam("id").toInt()
        data[id]?.let {
            ctx.json(it)
        } ?: ctx.json("not found")
    }

    app.put("/user/create") { ctx ->
        val user = ctx.validatedBody<User>()
            .check({ !data.containsKey(it.id) }, errorMessage = "This user id already exists.")
            .getOrThrow()
        data[user.id] = user
        ctx.status(201).result("User created successfully: $user")
    }
}
```

NOT COVERED...

- **Generics** - Improvements over java, like "reified" types.
- **Coroutines** - Concurrency inspired by C#, Javacript, Go, ...
- **Debugging** - Breakpoints, Profiler, Chrome extension.
- **Exceptions** - Simplified handling for unusual errors.
- **Builders** - For creating your own DSL libraries.
- **Tools** - Monitoring, Testing, Static Analysis, CI, Gradle/Maven, ...
- **Reflection** - Runtime class analysis, enables easy to use libraries.
- **Java** - Tons of syntactic sugar improving java usability.

HOW TO LEARN

- **Books** - https://kotlinlang.org/docs/books.html
- **Kotlin Koans** - "Hands-on" exercise approach.
- **Try Kotlin** - Same web app as Kotlin Koans, self driven.
- **KScript** - Ease into it with small scripts
- **Documentation** - https://kotlinlang.org/docs/reference/
- **For Java Devs** - IntelliJ's "Convert Java File to Kotlin File"

HOW TO LEARN – WEB APP

Kotlin in Action › Chapter 2 › 2.1 › 1_HelloWorld.kt

Save | Save as | Arguments | JVM | Run

Program arguments

```
1  package ch02.ex1_1_HelloWorld
2
3  fun main(args: Array<String>) {
4      println("Hello, world!")
5  }
6
```

Compilation completed successfully — On-the-fly type checking

```
Hello, world!
```

Problems view | Console | Generated classfiles — This demo is running on Kotlin v. 1.2.71

HOW TO LEARN – DOCUMENTATION

Kotlin LEARN COMMUNITY TRY ONLINE

Reference | Tutorials | Books | More resources

- Overview
- Getting Started
- Basics
  - Basic Types
  - Packages and Imports
  - Control Flow
  - Returns and Jumps
- Classes and Objects
  - Classes and Inheritance
  - Properties and Fields
  - Interfaces
  - Visibility Modifiers
  - Extensions
  - Data Classes

Control Flow: if, when, for, while

Edit Page

If Expression

In Kotlin, `if` is an expression, i.e. it returns a value. Therefore there is no ternary operator (condition ? then : else), because ordinary `if` works fine in this role.

```
// Traditional usage
var max = a
if (a < b) max = b

// With else
var max: Int
if (a > b) {
    max = a
} else {
    max = b
}

// As expression
val max = if (a > b) a else b
```

if branches can be blocks, and the last expression is the value of a block:

HOW TO LEARN – DOCUMENTATION

For Loops

`for` loop iterates through anything that provides an iterator. This is equivalent to the `foreach` loop in languages like C#. The syntax is as follows:

```
for (item in collection) print(item)
```

The body can be a block.

```
for (item: Int in ints) {
    // ...
}
```

As mentioned before, `for` iterates through anything that provides an iterator, i.e.

- has a member- or extension-function `iterator()`, whose return type
  - has a member- or extension-function `next()`, and
  - has a member- or extension-function `hasNext()` that returns `Boolean`.

All of these three functions need to be marked as `operator`.

HOW TO LEARN – KSCRIPT

```kotlin
#!/usr/bin/env kotlinc -script

import java.io.File

val folders: Array<out File> =
    File(args[0]).listFiles { file -> file.isDirectory }!!

folders.forEach { folder -> println(folder) }
```

```
/opt/KotlinJavascriptProgram$ ./dir.kts /opt/KotlinJavascriptProgram/
/opt/KotlinJavascriptProgram/.idea
/opt/KotlinJavascriptProgram/out
/opt/KotlinJavascriptProgram/src
```

LIBRARIES

- Thousands of Java libraries.
- Micro Web Frameworks - Jooby, Javalin, Spark, Ktor
- Testing - Spek, JUnit, TestNG, Mockito, AssertJ
- Documentation - Dokka
- Build Tools - Gradle, Maven
- JSON - Jackson, Gson

LINKS

- Blog post "Why Kotlin Is Better Than Whatever Dumb Language You're Using" https://steve-yegge.blogspot.com/2017/05/why-kotlin-is-better-than-whatever-dumb.html
- https://kotlinlang.org/
- Huge list of libraries, websites, tutorials, books, and other resources https://github.com/mcxiaoke/awesome-kotlin
- Some inspiration from this presentation: https://speakerdeck.com/alexgherschon/introduction-to-kotlin
- IntelliJ IDE, Community Edition is free: https://www.jetbrains.com/idea
- My webpage: https://willwinder.com
- My github: https://github.com/winder