



Android history and basics of Kotlin

Android Lecture 1

2023

Lukáš Prokop

Simona Kurňavová



Finishing subject

<https://d3s.mff.cuni.cz/teaching/nprg056/>

Agenda

- Android OS history
- Development options
- Kotlin
- Demo
- Q&A

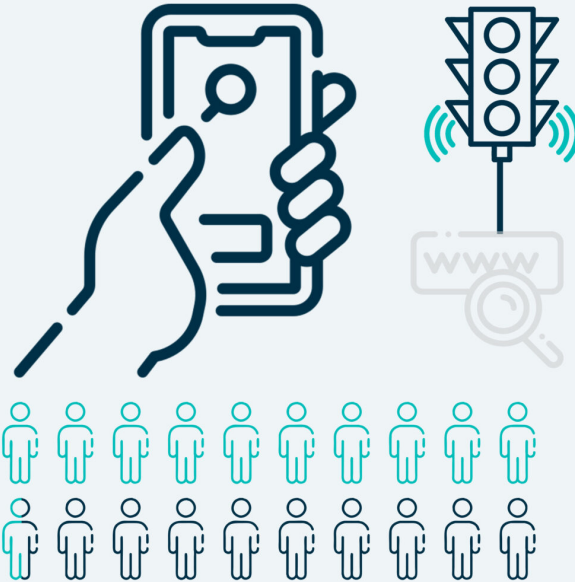
Why mobile development

Why mobile development

Ubiquitous

Quick

Convenient



In 2019,
53%
of the total **web traffic**
came from mobile users

Source: BroadbandSearch (2019)

Research.com

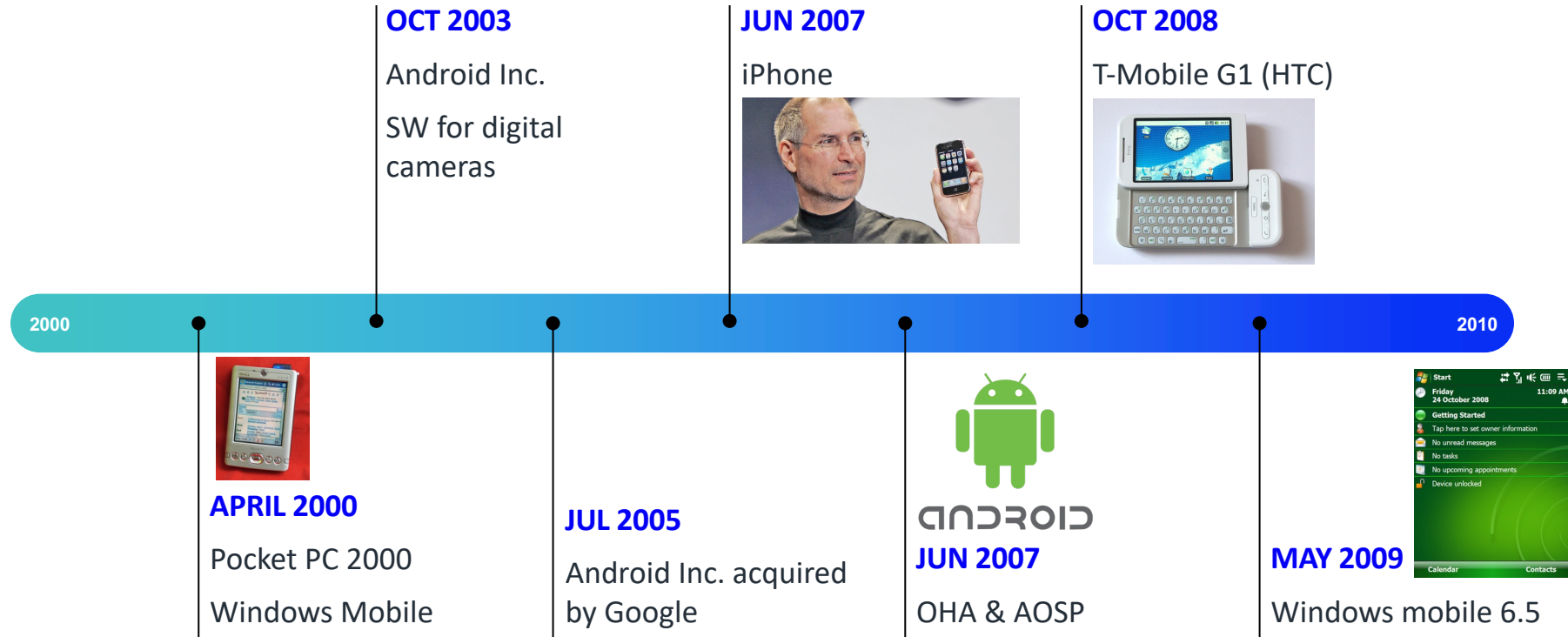
<https://research.com/software/mobile-vs-desktop-usage>

Mobile device specifics

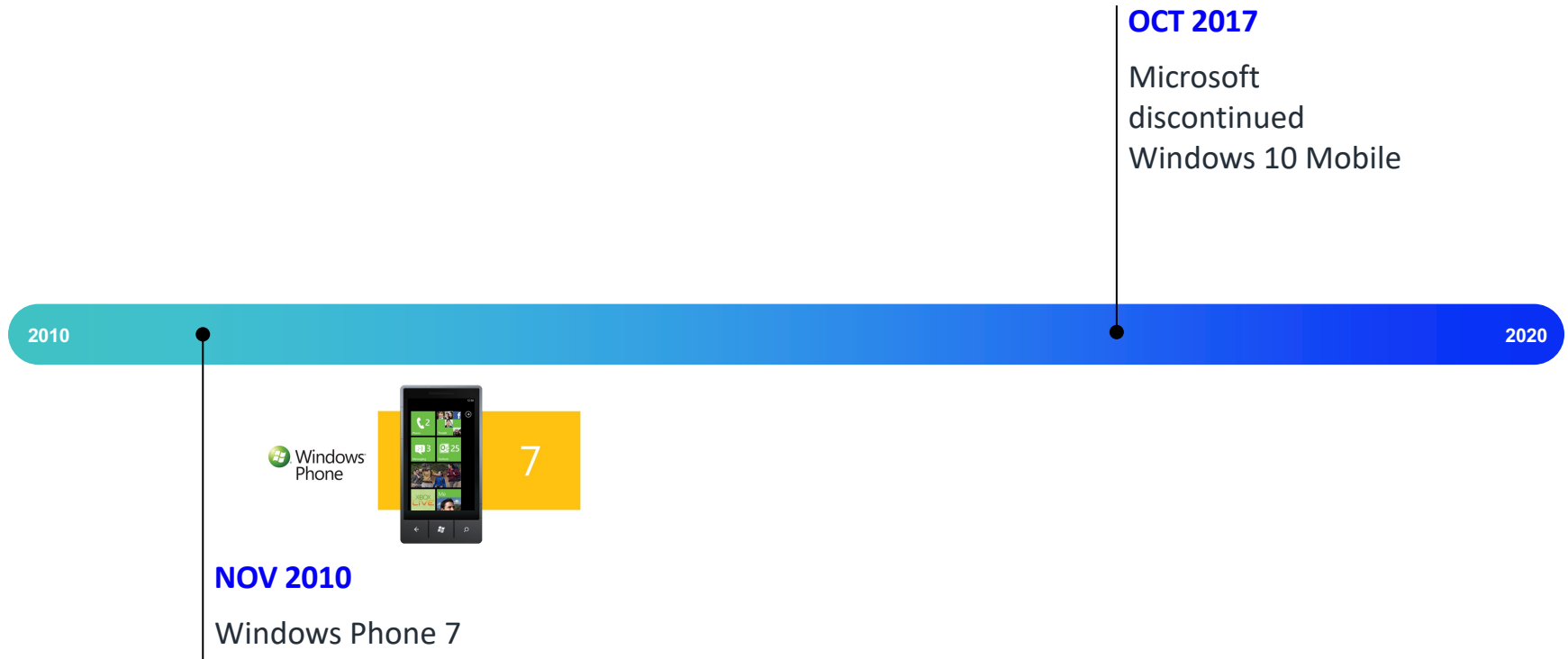
- Not enough computation power
- Changing state – screen orientation, foldables
- Unstable network connection
- Small battery

History

Timeline (content example)



Timeline (content example)



HTC G1



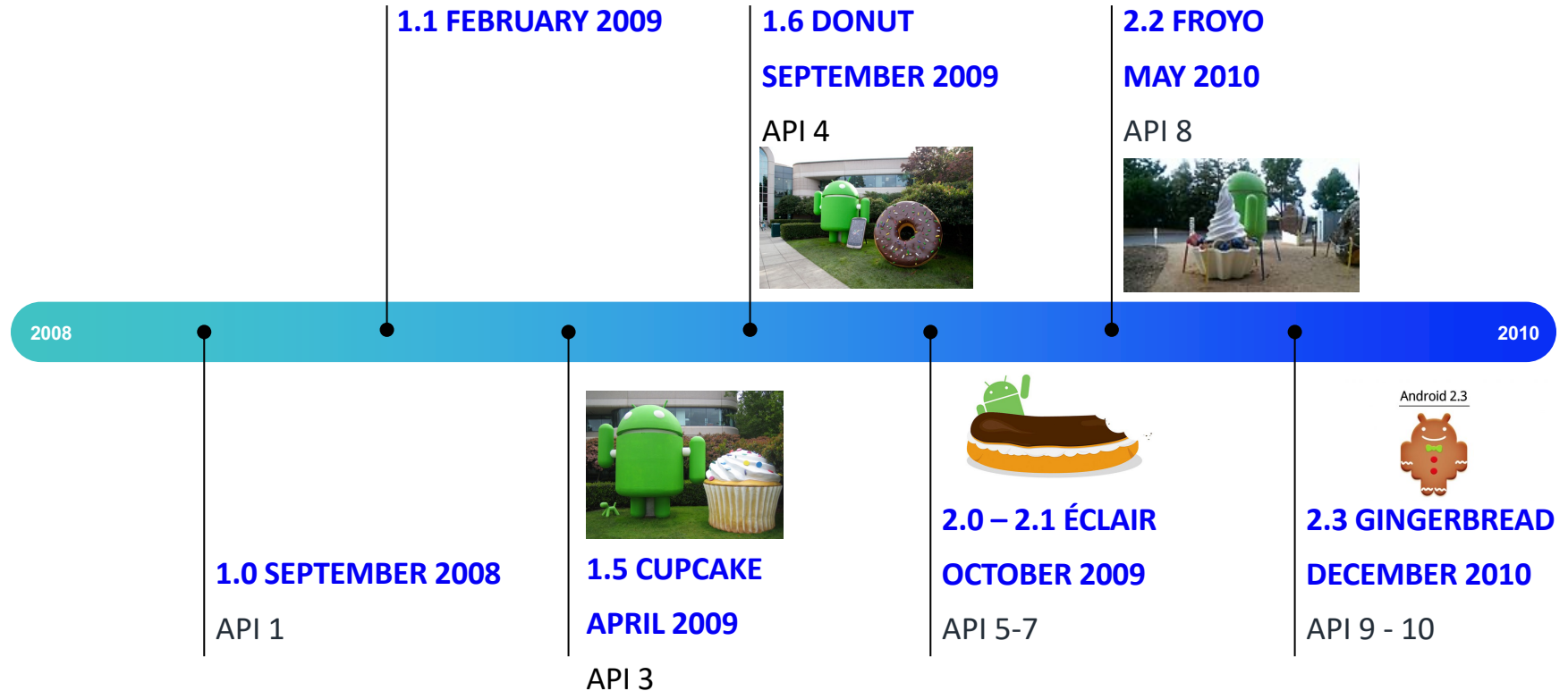




Android

- Linux based OS
 - No shell, no access to root (by default)
 - GNU C library (glibc) replaced by Bionic
- Open source
 - <https://source.android.com>
 - Just the OS (Google play store and services are proprietary)

Android



Android



Android Nougat

7.0 API 24 August 2016

- Multi window
- Quick setting tiles

7.1 API 25 October 2016

- App shortcuts

Android Oreo

8.0 API 25 August 2017

- **Picture in Picture**
- **Notification channels**
- **Custom fonts**
- **Autosize text view**
- **Multi display**
- **Project treble**
 - Sony, Nokia, OnePlus

8.1 API 27 October 2017

- **Neural Network API**
- **Video thumbnail extractor**
- **Wallpapers color API**
- **Cryptography update**
 - Conscript over Bouncy castle

Android Pie

9.0 API 28 August 2018

- **Display cutout**
- **Notification – messaging**
- **Multicamera support**
- **Image decoder**
- **Animation**
 - GIF, WebP animated images
 - HDR VP9, HEIF and Media APIs

Android 10

10 API 29 September 2019

- **Gesture navigation**
- **Smart replies**
- **Dark theme**
- **Foldables**

Android 11

11 API 30 September 2020

- Chat bubbles
- Notification history
- One time permission
- Permission auto-reset
- 5G detection API

Android 12

12 API 31 October 2021

- **Material You – design refresh**
- **Splash screen API**
- **Bluetooth permissions**
 - Scan for nearby device don't need location

12L API 32 March 2022

- **Optimize for large screens and foldables**

Android 13

13 API 33 August 2022

- **Notification permission**
- **Nearby wifi devices permission**

Android 14

14 API 34 October 2023

- Exact alarm permission denied by default
- Partial access to photos and videos
- Change to non-dismissable notifications
- Security changes

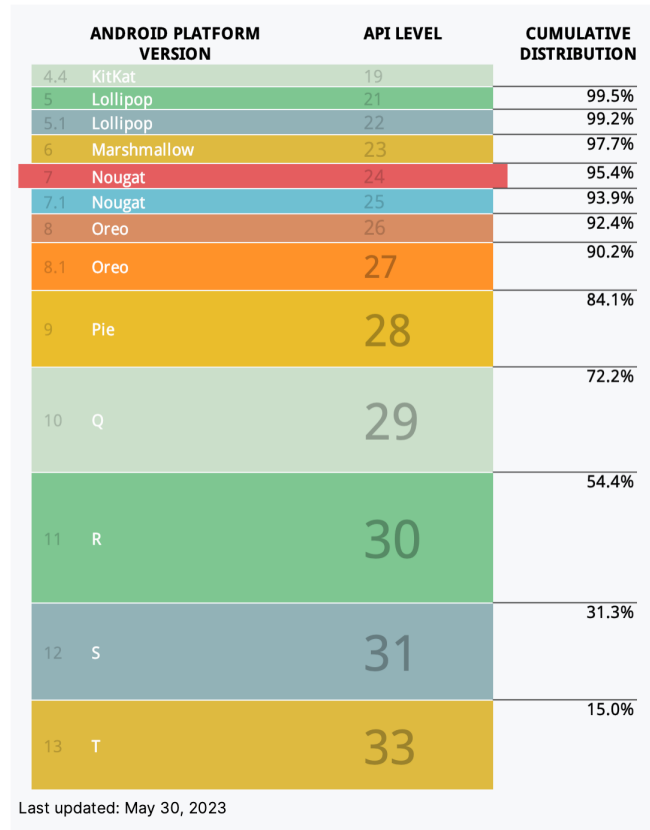
Android today - versions

<https://developer.android.com/about/dashboards/>

<https://gs.statcounter.com/android-version-market-share/mobile-tablet/worldwide>

<https://techjury.net/blog/android-market-share/>

<https://www.appbrain.com/stats/top-android-sdk-versions>



Android


- **Android – phones and tablets**
- **WearOS - smartwatch**
 - Extended notification center
 - Sporttester
- Chrome OS
- Android Auto
 - Mirror optimized UI to built-in infotainment
- Android automotive
 - Standalone OS in cars
- Android Things – deprecated January 2022
 - IoT
- Google glass
 - Glass explorer program – retired 2015


Android ecosystem


- **Apps on Google play store**
- **Different monetization models**
 - Free
 - Paid
 - In-App products (subscriptions and one-time)
- Android users not willing to pay for apps => Ads
- Available in most countries


Android cons


- **Fragmentation**
 - OS adoption
 - Sizes
 - Performance differences
 - CPUs
- Low end devices
- Low quality apps
 - Wireless charger simulator

**shikha nayak**
★ ★ ★ ★ ★ May 27, 2021
No stars for this ridiculous app.... It is just an app to make April Fool and in real there is no wireless charging of your phone in emergency.... I just hate it

**SimStopperTM**
★ ★ ★ ★ ★ April 12, 2019
Absolute garbage! Waste of time! Doesn't do *anything* at all! My phone was at 3% and I had no charger so I downloaded the app. It didn't increase at all, it just kept driving. This is practically an April Fools app. Don't download it!

**TendondoesYT**
★ ★ ★ ★ ★ April 30, 2021
Got 100% in less than an hour... THANK YOU, other people just lie about it not charging the phone probaly because they use a phone from 1997 or something!!

**KittyJ Gachagamer**
★ ★ ★ ★ ★ November 12, 2020
AMAZING APP!! 🥳🥳🥳 It actually charges my phone like a miagician!!! Don't look at the 1 star rating cuz it's not true!! The reason why it's not working cuz u done it wrong, ur supposed to place it on top of a phone or any other device to charge!! I recommend!!! 😄😄😄

**Paul Hanlin**
★ ★ ★ ★ ★ February 13, 2021
I give this app no stars because it doesn't work like it say it does. I can't get it to do nothing but take up space on my phone and I should have listened to my friends when they not to down load this app

Android - pros

- **Open source**
- **Many users**
- **Many apps**
- **Customisation (Keyboard, Launcher)**
- **Developer one-time fee \$25 (Apple \$99 Annual)**
 - Alpha, beta channels, stage rollout
 - Basic crash reporting
 - Pre-launch reports
 - Android Vitals
- Dev tools available on all platforms (Linux, Windows, MacOS)
- Huge open source community
 - OkHttp, Retrofit, Ktor, Dagger, Hilt, Flipper, RxJava
- Reference Pixel device

Android - security

- **Root user not available by default**
 - Rooting to get extra functionality, often break warranty
- Permissions
 - < API-23 – All permissions granted during installation
 - >= API-23 – Runtime permissions, user have to approve “dangerous” permissions
 - TargetSDK change the behaviour
- Bouncer
 - Service which scans Google play store for malicious apps

Development

Options

- **App-like mobile web**
- **Other language frameworks (Xamarin, Flutter)**
- **WebView based framework**
- **Native**
 - Kotlin – Support for Android announced on GoogleIO 2017
 - Java
 - C/C++ (Mainly games and libraries)

Development tools

- **Android Studio**
- **SDK**
 - ADB
 - Lint
 - Emulator
 - aapt, aidl, dx, (Jack & Jill – Java 8, now deprecated)
 - D8
 - Proguard/R8
- **NDK (C/C++ development)**
 - Cross compile
 - Native libraries

Gradle

- **Build system**
- **Use Kotlin DSL (or Groovy)**
- **Extensible**

Kotlin

Ketchup



Island



Kotlin



Kotlin current version



The K2 compiler for the JVM is now in Beta

Great improvements for the standard library

Preview of custom memory allocator in Kotlin/Native

Size-related optimizations in Kotlin/Wasm

<https://kotlinlang.org/lp/10yearsofkotlin/>

Why Kotlin

- **Concise**
 - Reduce boilerplate code
- **Safe**
 - Avoid NullPointerException
- **Interoperable**
 - Works well legacy java code
- **Tool friendly**
 - Support in IDEs (IntelliJ Idea, Android Studio, Eclipse, Netbeans, standalone compiler)

<https://kotlinlang.org/docs/basic-syntax.html>

<https://kotlinlang.org/docs/idioms.html>

<https://kotlinlang.org/docs/coding-conventions.html#coding-conventions-for-libraries>

Kotlin - Concise

- **Data classes**
- **Named parameters**
- **Operator overloading**
- **Smart casting**
- **Default parameter values**
 - Replace method overloading
- **Extension functions**
- **Lambda expressions**
- **String interpolations**

Data classes

- **Methods generated by compiler**
 - Equals()/hashCode()
 - toString()
 - Copy()
- Only fields in primary constructor

```
data class Person(  
    val name: String,  
    val surname: String,  
    val street: String,  
    val buildingNumber: Int  
)
```

```
val bruceWayne = Person(  
    name = "Bruce",  
    surname = "Wayne",  
    street = "Wayne Manor",  
    buildingNumber = 1  
)  
  
val robin = bruceWayne.copy(name = "Robin")
```

Operator overloading

```
data class ComplexNumber(  
    val real: Double,  
    val imaginary: Double  
) {  
    operator fun plus(increment: ComplexNumber): ComplexNumber {  
        return ComplexNumber(real + increment.real, imaginary + increment.imaginary)  
    }  
}
```

Extension functions

- You can extend classes which are not yours
- Quite powerful
- Easy to misuse

```
fun Int.isEven() = this % 2 == 0  
fun Int.isOdd() = this % 2 == 1
```

Smartcast

```
fun smartCastDemo(x: Any) {  
    when (x) {  
        is Int -> println("Integer value abs(x): ${x.absoluteValue}")  
        is String -> println("String x.toLowerCase: ${x.toLowerCase(Locale.getDefault())}")  
        else -> println("x is not Integer or String")  
    }  
}
```

Lambda expressions

- Function can be passed as argument or returned from other function

```
fun <T, R> transform(item: T, transformation: (T) -> R): R {  
    return transformation(item)  
}
```

```
fun <T, R> T.transform(transformation: (T) -> R): R {  
    return transformation(this)  
}
```

```
val number = 1  
number.transform { it.toString() }  
transform(number) { it.toString() }
```

If/When as expression

```
fun Int.describe(): String = when {  
    this < 0 -> "Is negative"  
    this == 0 -> "Is zero"  
    else -> "Is positive"  
}
```

Companion object

- **Methods/properties do not belong to instance**
- **Similar static in java**
- **Have context of the class**
- **Can implement/extend another interface/class**

Kotlin - safe

- **Null safety enforced at compile time**
 - It's part of type system

```
val name = "Lukas"
val nickname: String? = null

println(name)
println(name.length)
println(nickname?.length) // ?. safe operator
nickname?.let { println(it.length) } // ?.let as null check
println(nickname)
println(nickname ?: "Nickname is not set") // ?: Elvis operator
println(nickname!!.length) // !! Unsafe operator - do not use
```

Kotlin - safe

- **Immutable by default**
 - List vs. MutableList, Map vs. MutableMap

Kotlin interoperability

- Java
- Swift
- Kotlin Multiplatform

Thank you

Lukáš Prokop
Simona Kurňavová

Lukas.Prokop@gendigital.com

Simona.Kurnavova@gendigital.com



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