KOTLIN

LESS CODE, MORE FUN

Speaker notes

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THANK YOU, THAT CONFERENCE SPONSORS!

Speaker notes

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Microsoft®

.NET

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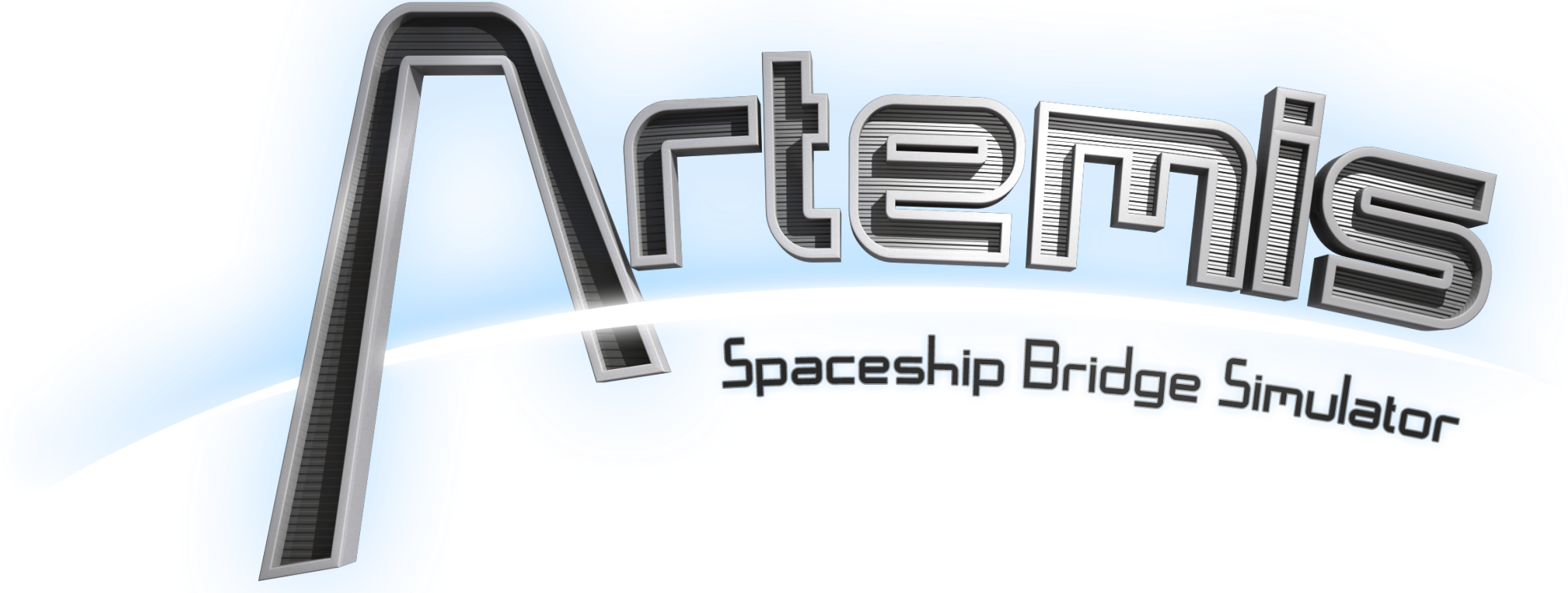

Speaker notes

- Save That Random Universe?
- in Mangrove
  - Near the side entrance
  - Past Open Spaces, next to Mess Hall

WHAT IS...

Kotlin

Speaker notes

- First unveiled in 2011 (after being in dev for a year)
- Open-sourced in 2012
- Version 1.0 released on February 15th, 2016
- JetBrains said most languages were lacking the features they wanted
  - Except Scala, but it was slow to compile
- JetBrains hopes to drive IntelliJ sales

"STATICALLY TYPED PROGRAMMING LANGUAGE FOR MODERN MULTIPLATFORM APPLICATIONS"

STATICALLY TYPED

```
val numbers: List<Int> = listOf(1, 4, 7, 10, 23)
```

```
enum class Sport {
    Baseball,
    Football,
    Soccer,
    Basketball
}

data class Team(val city: String, val teamName: String, val sport: Spo
```

Speaker notes

- Statically typed:
  - Know type of variable at compile time
    - Java
    - C, C++, C#
  - Kotlin uses type inference
    - Type system can figure the type out
    - Don't always have to specify
    - Will warn if not clear
- Modern:
  - Concise code
  - Lots of features

MULTI-PLATFORM

Build Applications For

Speaker notes

- First-class language on Android
- Interoperable with JVM
- Transpile Kotlin into JavaScript
- Compile native code (without VM)
  - Windows
  - Linux
  - MacOS
  - iOS
  - Android
  - WebAssembly

100% JAVA INTEROPERABILITY

```
import io.reactivex.Flowable
import io.reactivex.schedulers.Schedulers

Flowable
    .fromCallable {
        Thread.sleep(1000) //  imitate expensive computation
        "Done"
    }
    .subscribeOn(Schedulers.io())
    .observeOn(Schedulers.single())
    .subscribe(::println, Throwable::printStackTrace)
```

Speaker notes

- Call existing Java libraries
- Use Java classes
- Can call Kotlin classes from Java
- May need a bit of tweaking

FIRST-CLASS LANGUAGE ON ANDROID

```
override fun onCreate(savedInstanceState: Bundle?) {
    super.onCreate(savedInstanceState)
    setContentView(R.layout.activity_main)
    setSupportActionBar(toolbar)
    ...
```

Speaker notes

- Official language on Android
- Announced at Google I/O 2017 (May 2017)
- Option to build apps in Kotlin right away
- Only adds about 100K to the APK size

Why Kotlin?

Concise

Drastically reduce the amount of boilerplate code.

See example

Safe

Avoid entire classes of errors such as null pointer exceptions.

See example

Interoperable

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

See example

Tool-friendly

Choose any Java IDE or build from the command line.

See example

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VAL AND VAR

```java
// Java
final String name = "Joe Smith"
```

```kotlin
// Kotlin
val name: String = "Joe Smith"
```

```java
// Java
int age = 23
```

```kotlin
// Kotlin
var age: Int = 23
```

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DATA CLASSES

```java
// Java
public class Person {
    private final String first;
    private final String last;
    private int age;

    public Person(String first, String last, int age) {
        this.first = first;
        this.last = last;
        this.age = age;
    }

    public String getFirst() {
        return first;
    }
```

Speaker notes

- Compiler automatically creates:
  - `equals()` and `hashCode()`
  - `toString()` -> `Person(first=Michael, last=Fazio, age=33)`
  - `componentN()` functions in order of declaration
    - e.g. val first = person.component1(), val age = person.component3()
- Cannot be `abstract`, `open`, `sealed`, or `inner`

DATA CLASSES

COMPONENT FUNCTIONS, DESTRUCTURING DECLARATIONS, COPY

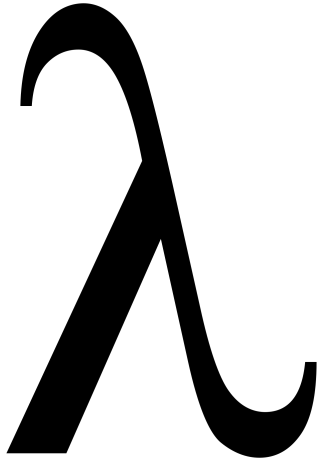
```
data class Person(val first: String, val last: String, var age: Int)
```

```
val hazel = Person(first = "Hazel", last = "Fazio", age = 4)
println(hazel) // Person(first=Hazel, last=Fazio, age=4)

val (first, last, age) = hazel
println("$first $last, $age years old.") // Hazel Fazio, 4 years old.

val hazelNY = hazel.copy(age = 5) // Next year
```

Speaker notes

- `componentN()` functions in order of declaration (created automatically)
  - e.g. val first = person.component1(), val age = person.component3()
- Destructuring Declarations
  - Helped by component functions
- `copy()` can be used to create a new instance of the type
  - `person.copy(age = 34)`
- String interpolation

LAMBDA FUNCTIONS



```
val sum = { x: Int, y: Int -> x + y }
```

```
val baseballTeams: List<Team> =
    teams.filter { team -> team.sport == Sport.Baseball}
```

```
strings
    .filter { it.length == 5 }
    .sortedBy { it }
```

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SMART CASTS

```java
// Java
private int calculateLength(Object o) {
    if(o instanceof String) {
        final String s = (String) o;
        return s.length();
    }
    return 0;
}
```

```csharp
// C#
private int CalculateLength(object o) {
    if(o is string s) return s.Length;
    return 0;
}
```

```kotlin
// Kotlin
fun calculateLength(v: Any) : Int {
    if(v is String) return v.length //v is automatically cast to a Str
```

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RANGES

```java
// Java
private boolean isInRange(int i) {
    return i >= 1 && i<= 10;
}
```

```kotlin
// Kotlin
fun isInRange(i: Int) : Boolean {
    return i in 1..10
}
```

```kotlin
// Kotlin
fun isInRange(i: Int) = i in 1..10
```

Speaker notes

- rangeTo() +
- downTo()
- reversed()
  - Last to first with negative step
- step()
  - `(1..12 step 3).last == 10`
- Single-expression function in last example

WHEN EXPRESSIONS

```
when (x) {
    1 -> print("x == 1")
    2 -> print("x == 2")
    else -> { // Note the block
        print("x is neither 1 nor 2")
    }
}
```

```
val result: String = when (x) {
    0, 1 -> "x == 0 or x == 1"
    else -> "otherwise"
}
```

```
when (x) {
    in 1..10 -> print("x is in the range")
    in validNumbers -> print("x is valid")
    !in 10..20 -> print("x is outside the range")
    else -> print("none of the above")
}
```

Speaker notes

- Replaces `switch`

TRAVERSING MAPS

```java
// Java
public void printTeams(Map<String, Team> teamMap) {
    for(Map.Entry<String, Team> entry : teamMap.entrySet()) {
        System.out.println(entry.getKey() + " - " + entry.getValue());
    }
}
```

```kotlin
// Kotlin
fun printTeams(teamMap: Map<String, Team>) {
    for ((key, value) in teamMap) {
        println("$key - $value")
    }
}
```

Speaker notes

- Deconstructed declaration of the entry

NULL

THE BILLION-DOLLAR MISTAKE

```
var notNullString: String = "This can't be null"

var nullableString: String? = "This could be null"
```

Speaker notes

- Tony Hoare
  - Created null reference in 1965, causes lots of issues

NULL SAFETY

```
var a: String = "abc"
a = null // compilation error
```

```
var b: String? = "abc"
b = null // ok
```

```
val l = a.length
```

```
val l = b.length // error: variable 'b' can be null
```

Speaker notes

- Nulls are checked at runtime

NULL SCENARIOS

- throw NullPointerException();
- Usage of the `!!` operator
- Data inconsistency related to initialization
  - An uninitialized `this` available in a constructor and is used somewhere
  - A superclass constructor calls an open member whose implementation uses uninitialized state
- Java interop

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- !! == Not-null assertion operator
  - Converts any value to a non-null type or throws an exception if null
  - "[!!] is for NPE-lovers"
- Incorrect nullability
  - Add null to MutableList instead of MutableList

NULL SAFETY

SAFE CALLS

```
val brewers: Team? = Team("Milwaukee", "Brewers", Sport.Baseball)
val whiteSox: Team? = Team("Chicago", "White Sox", Sport.Baseball)
val devilRays: Team? = null

val baseballTeams = listOf(brewers, whiteSox, devilRays)
```

```
val nicknames: List<String> = baseballTeams.map {
    if (it != null) it.name else ""
}
```

```
val nicknames: List<String> = baseballTeams.map {
    it?.name ?: ""
}
```

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ELVIS OPERATOR

```java
// Java
public Sport getTeamSport(Team team) {
    if(team != null) {
        return team.getSport();
    }

    return Sport.Unknown;
}
```

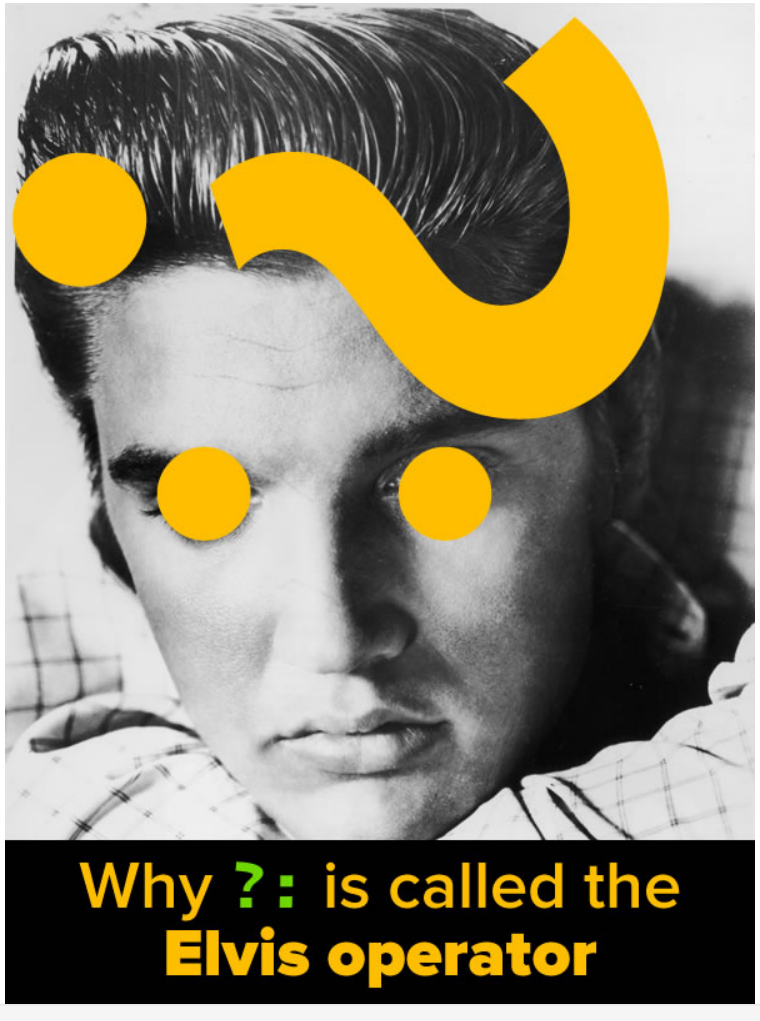
```kotlin
// Kotlin
fun getTeamSport(team: Team?): Sport
    = if(team != null) team.sport else Sport.Unknown

fun getTeamSport(team: Team?): Sport = team?.sport ?: Sport.Unknown
```

Speaker notes

- Same as ?? in C#
- "Null coalescing operator"

ELVIS OPERATOR



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NULL SAFE SCOPING

```
fun findTeam(city: String = "", nickname: String = ""): Team? {
    return this.teams.firstOrNull {
        team -> team?.city == city || team?.name == nickname
    }
}

findTeam(nickname = "Brewers")?.let {
    //This will only run if findTeam(...) returns a non-null value
}
```

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NULL SAFE SCOPING

```
fun listTeams() {
    val brewers: Team? = Team("Milwaukee", "Brewers", Sport.Baseball)
    val whiteSox: Team? = Team("Chicago", "White Sox", Sport.Baseball)
    val devilRays: Team? = null

    println(this.getSummary(brewers))
    println(this.getSummary(whiteSox))
    println(this.getSummary(devilRays))
}
```

```
private fun getSummary(team: Team?): String {
    var fullName: String = "N/A"

    team?.let({t -> fullName = "${t.city} ${t.name} (${t.sport})"})

    return fullName
}
```

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NULL SAFE SCOPING

```
private fun getSummary(team: Team?): String {
    return team?.let({ t -> "${t.city} ${t.name} (${t.sport})" }) ?: "
}
```

```
private fun getSummary(team: Team?): String {
    return team?.let { t -> "${t.city} ${t.name} (${t.sport})" } ?: "N
}
```

```
private fun getSummary(team: Team?): String {
    return team?.let { "${it.city} ${it.name} (${it.sport})" } ?: "N/A
}
```

```
private fun getSummary(team: Team?): String =
    team?.let { "${it.city} ${it.name} (${it.sport})" } ?: "N/A"
```

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JAVA HAS THESE, KOTLIN DOES NOT

- Ternary-operator (`a ? b : c`)
- Checked exceptions
- Primitive types that are not classes
- Static members
- Non-private fields

Speaker notes

- Checked exceptions lead to useless `try...catch` blocks
- Instead of static members, use package-level functions
  - Also can use object declarations or companion objects
- Use properties instead of fields
- `if` works just fine
  - `val max = if (a < b) b else a`

INSTEAD OF STATIC

```kotlin
package org.faziodev.kotlin

// Package-level function
fun nullSafeToUpper(value: String?) : String {
    return value?.toUpperCase() ?: ""
}

// Object declaration
object TeamSource {
    fun myFunction() { ... }
}
```

```kotlin
// Import the package and call the method
val upper: String = nullSafeToUpper(brewers?.name)

// Reference the function similarly to a static method
TeamSource.myFunction()
```

Speaker notes

- Package-level functions
- Object declarations
  - Work as singletons
- Companion objects

COMPANION OBJECTS

```
data class Team(val city: String, val name: String, var sport: Sport)
    companion object {
        fun createBaseballTeam(city: String, name: String)
            = Team(city, name, Sport.Baseball)
    }
}
```

```
val cubs = Team.createBaseballTeam("Chicago", "Cubs")
```

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ALL CLASSES ARE CLOSED

```
class Base(p: Int)

//This will not work
class Derived(p: Int) : Base(p)
```

```
open class Base(p: Int)

class Derived(p: Int) : Base(p)
```

Speaker notes

- open in Kotlin is opposite of `final` in Java
- Design and document for inheritance or else prohibit it.
  - Effective Java
- Things are explicit in Kotlin
- Exception: Abstract classes are open by default
- Classes are also public by default

ALL FUNCTIONS ARE CLOSED

```
open class Base {
    open fun openFun() {}
    open fun alsoOpenFun() {}
    fun notOpenFun() {}
}
```

```
class Derived() : Base() {
    //Overridden methods are open by default
    override fun openFun() {}

    // This can no longer be overridden
    final override fun alsoOpenFun() {}
}
```

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COLLECTIONS ARE IMMUTABLE

```
val teams: List<Team> = this.getBaseballTeams(this.allTeams)

val brewers: Team = Team("Milwaukee", "Brewers", Sport.Baseball)

teams.add(brewers) //add doesn't exist on List
```

```
val teams: MutableList<Team> = this.getBaseballTeams(this.allTeams)

val brewers: Team = Team("Milwaukee", "Brewers", Sport.Baseball)

teams.add(brewers) //Brewers added
```

```
val teams: List<Team> = listOf(brewers, reds, cubs)

val mutableTeams: MutableList<Team> = mutableListOf(brewers, reds, cub
```

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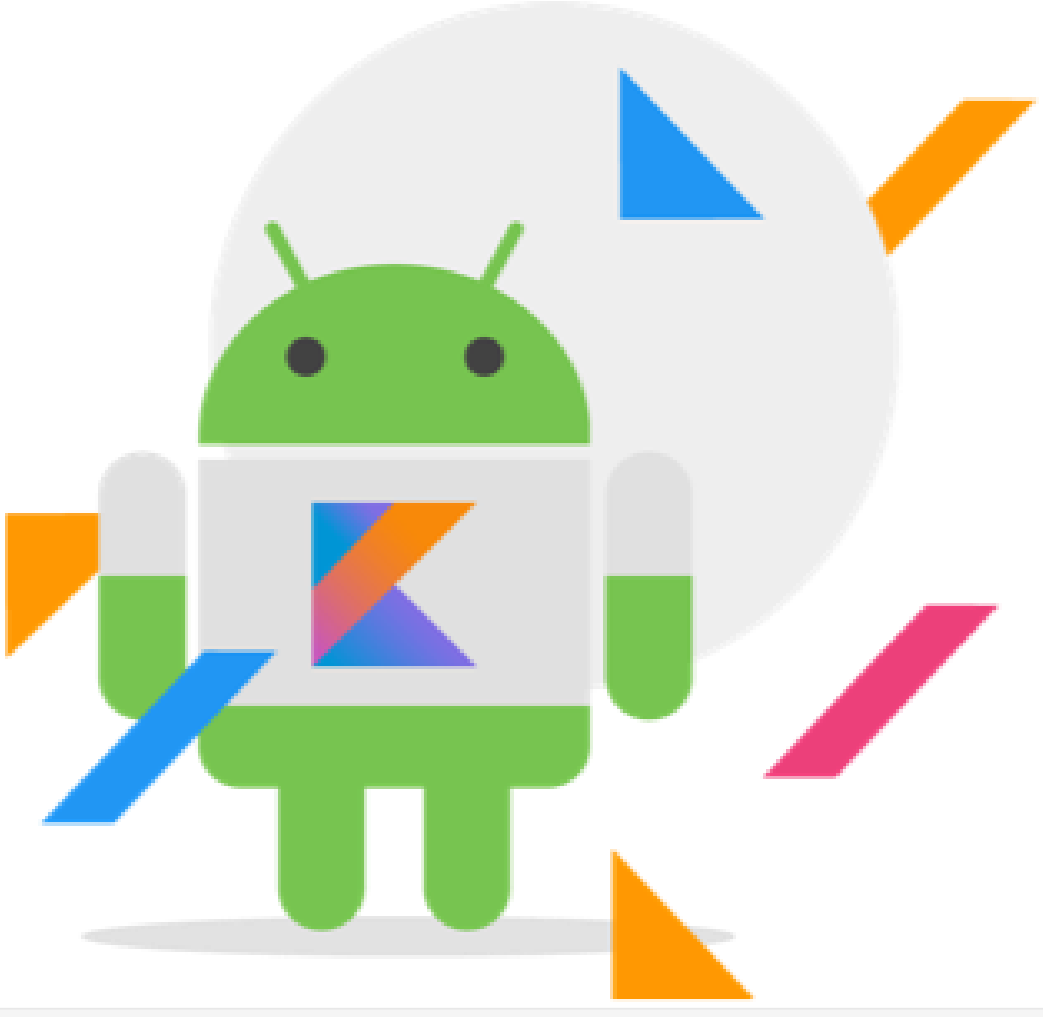
KOTLIN ON ANDROID



Speaker notes

- Official language for Android
- Available in Android Studio by default +

KOTLIN ON ANDROID

ONCLICKHANDLERS

```java
// Java
loginButton.setOnClickListener(new View.OnClickListener() {
    public void onClick(View v) {
        logInUser();
    }
});
```

```kotlin
// Kotlin
loginButton.setOnClickListener {v -> logInUser() }

loginButton.setOnClickListener { logInUser() }
```

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KOTLIN ON ANDROID

LATEINIT

```
private lateinit var logo: ImageView
```

```
this.logo = this.findViewById<ImageView>(R.id.logo)
```

Speaker notes

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KOTLIN ON ANDROID

ANKO

- Anko Commons
- Anko Layouts
- Anko SQLite

Speaker notes

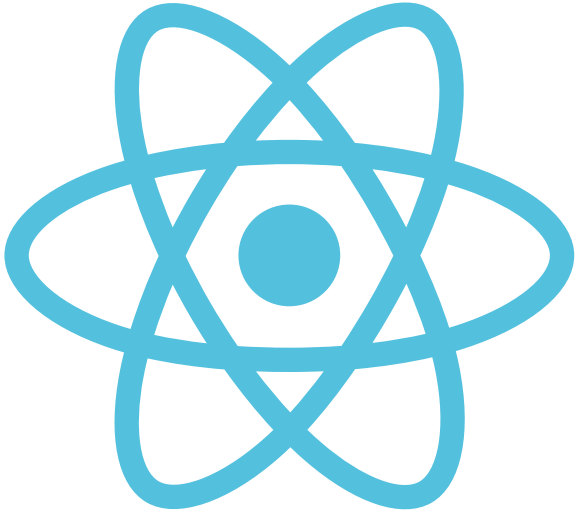
- Speed up Android dev
- Anko Commons
  - Intents
  - Dialogs/toasts
  - Logging
  - Resources/Dimensions
- Anko Layouts
  - DSL (Domain-specific language) for Android layouts
- Anko SQLite
  - Simplifies working with SQLite DBs
- Anko Coroutines
  - Helps with Kotlin coroutines (async calls)

KOTLIN AND JAVASCRIPT

Speaker notes

- Converts into ES

KOTLIN AND REACT



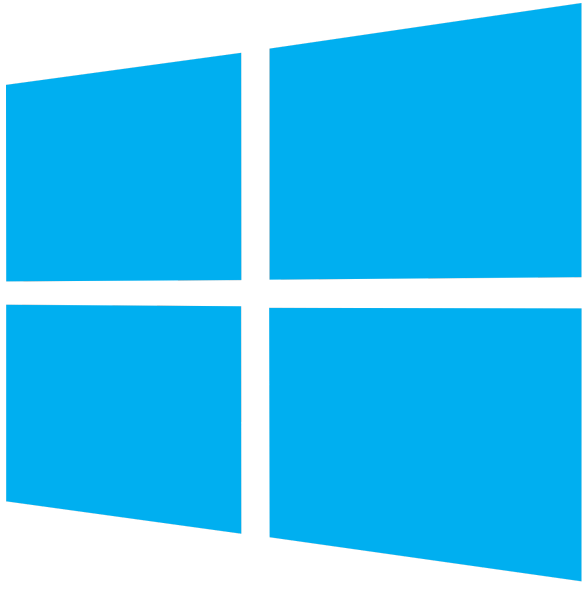
https://github.com/JetBrains/create-react-kotlin-app

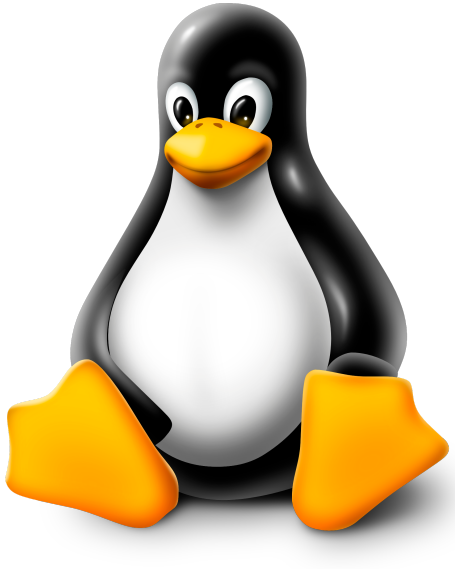
Speaker notes

- Transpiles to ECMAScript 5.1
  - ES2015 in the future
- Works with 3rd party libraries
- Strong typing available from TypeScript

KOTLIN NATIVE

DESKTOP





Speaker notes

- Compiles to Native code
- Currently in development

KOTLIN NATIVE

IOS

Speaker notes

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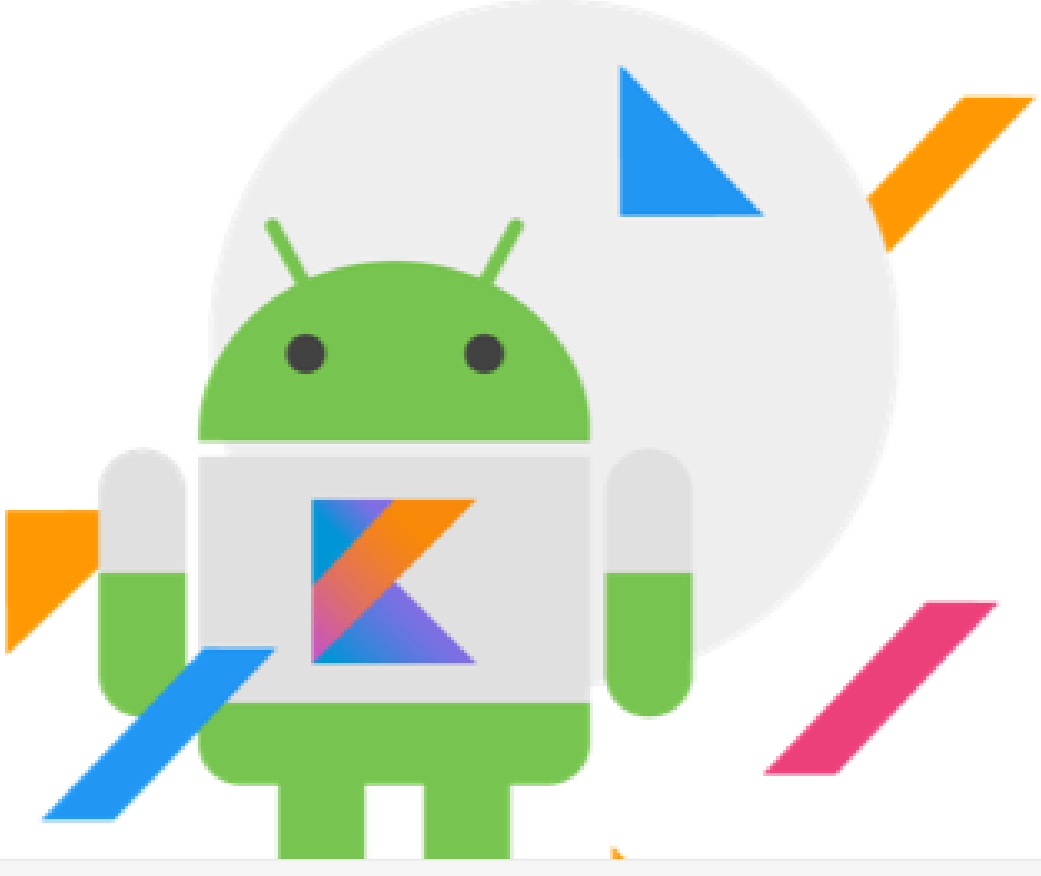
KOTLIN NATIVE

ANDROID



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QUESTIONS?

Speaker notes

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THANK YOU!

Kotlin

@faziodev

Speaker notes

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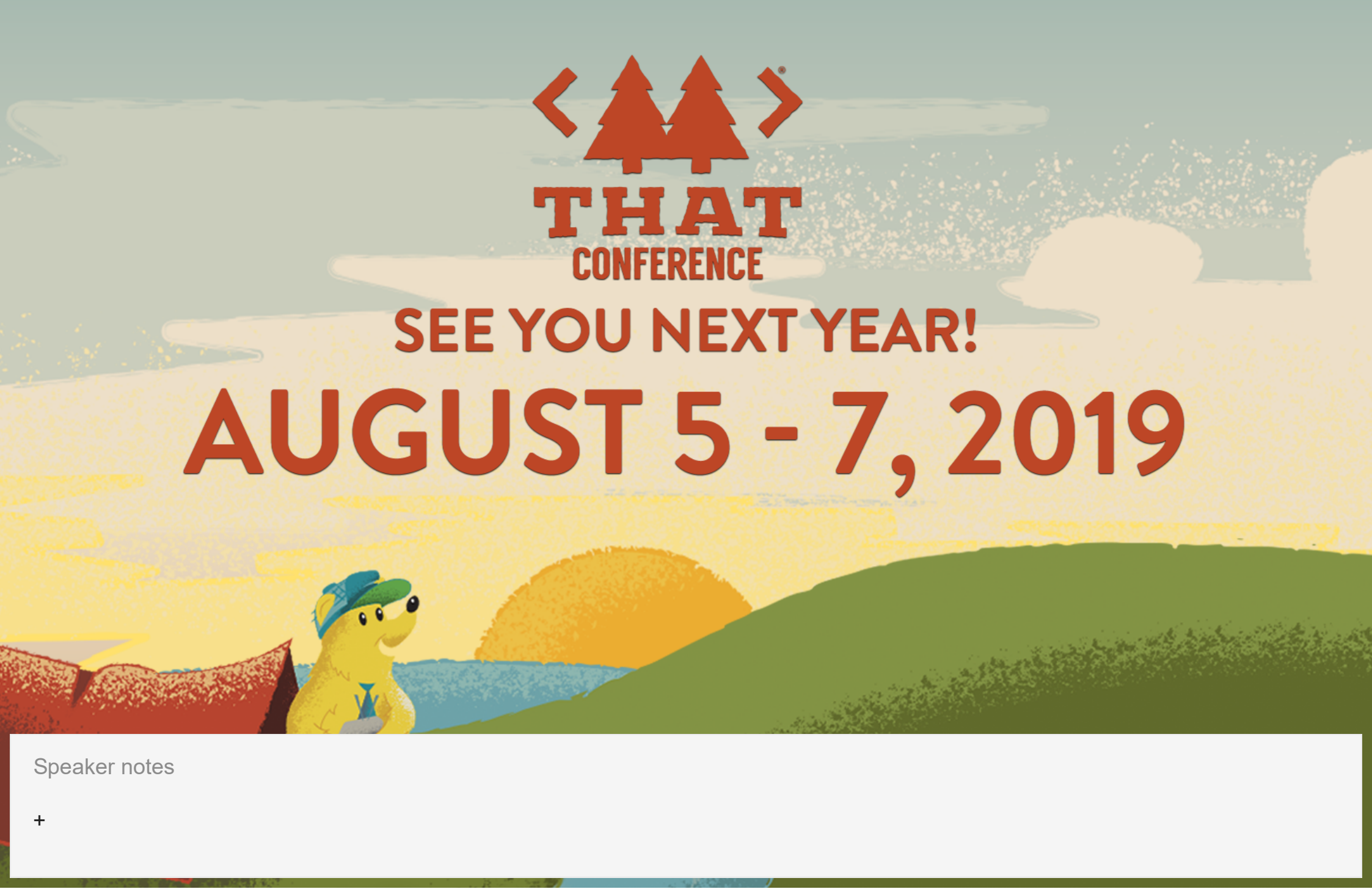

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