# Kotlin/JS

## Stay typesafe in the browser with Kotlin

Harald Pehl

02/2021



Red Hat

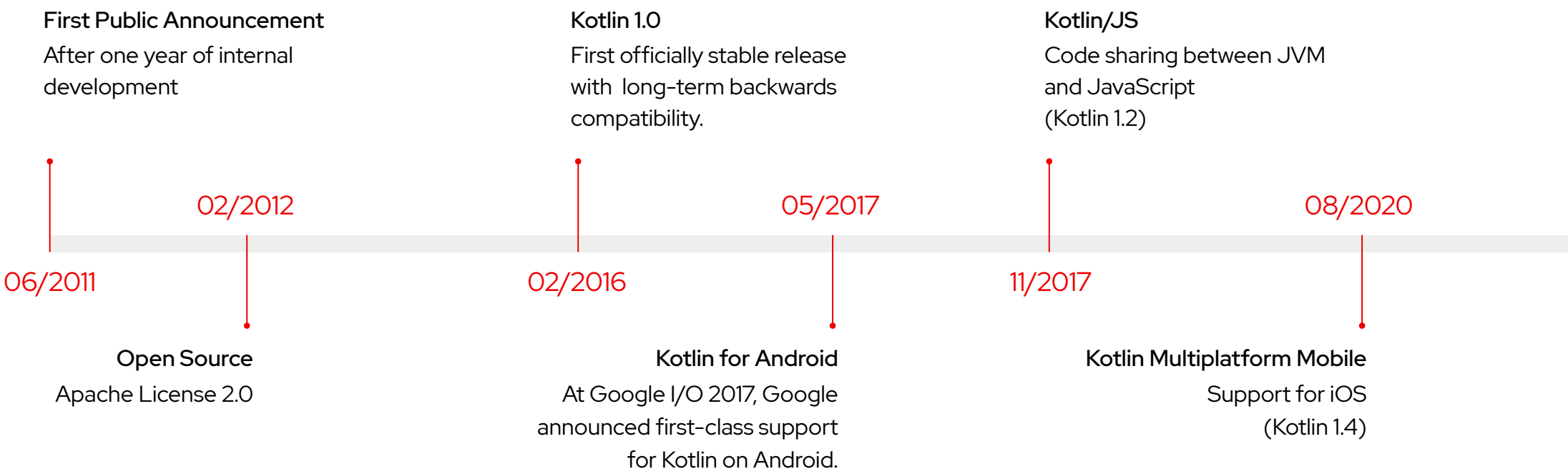
# Harald Pehl

- Senior Software Engineer at Red Hat
- WildFly Management / HAL / halOS
- PatternFly Fritz2

# What we'll discuss today

- Kotlin
- Getting Started
- Ecosystem
- JavaScript
- React
- Fritz2 / PatternFly

# A Brief History



# Highlights

## Why should I use Kotlin?

### Java Interoperability

No setup necessary

Getters / Setters

Static Members

### Concise Syntax

Type Inference

Data Classes

Extension Functions

### Safety First

Null Safety

Immutable

### Concurrency

Suspend

Coroutines

Channels

```kotlin
// POJO with getters, setters, `equals()`, `hashCode()`,
// `toString()` and `copy()` in a single line
data class Customer(val name: String, val email: String, val company: String)

// Use `object` to create a singleton
object ThisIsASingleton {
   val companyName: String = "Red Hat"
}

// Extension function for string
fun String.reverseCase(): String = this.map {
   if (it.isUpperCase()) it.toLowerCase() else it.toUpperCase()
}.joinToString("")

println("Hello World".reverseCase()) // "hELLO wORLD"

// Operator extension function for List<Int>
operator fun List<Int>.times(by: Int): List<Int> = this.map { it * by }

// filter a list using a lambda
val numbers = listOf(4, -6, 2, -8, 12).filter { it > 0 }

// same as `numbers.times(2)`
println(numbers * 2) // "[8, 4, 24]"
```

## Concise Syntax

- Data classes
- Objects
- Extension functions
- Operator overloading

```kotlin
var a: String = "abc" // Regular initialization means non-null
a = null // compilation error

var b: String? = "abc" // can be set null
b = null // ok

val l = a.length
val l = b.length // error: variable 'b' can be null
val l = if (b != null) b.length else -1
val l = b?.length ?: -1
val l = b!!.length

println(a?.length) // Unnecessary safe call
println(b?.length)

fun calculateTotal(obj: Any) {
   if (obj is Invoice)
       obj.calculateTotal()
}
```

## Safety

Built in null safety

Smart casts

```
import kotlinx.coroutines.async
import kotlinx.coroutines.delay
import kotlinx.coroutines.runBlocking

suspend fun compute(n: Long): Long {
    delay(100) // simulate computation
    return n
}

val sum = runBlocking {
    (1..1_000_000L).map {
        async { compute(it) }
    }.sumOf { it.await() }
}
println("Sum: $sum")
```

| delay | 100 | 200 | 500 | 1000 | 2000 |
|---|---|---|---|---|---|
| ∅ time of 10 runs | 2489 | 2533 | 2687 | 2978 | 3821 |

## Concurrency

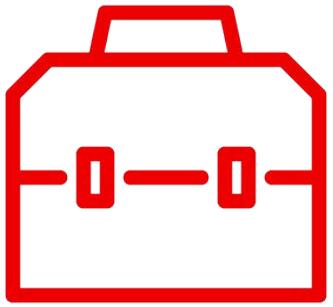
Coroutines

Suspend

Async

# Kotlin/JS Setup

## How to create a new project



### Gradle Build Script

Write from scratch or generate using IDE wizards.

### Standard Library

Most of the Kotlin standard library is available for Kotlin/JS.

### Webpack

Webpack is used to build, bundle and run the application.

### NPM / Yarn

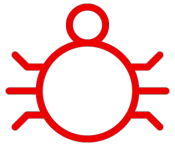
Declare npm dependencies in the Gradle build script.

# Run
# Debug
# Test

## Using the Kotlin/JS gradle plugin

### Run

The run task that lets you run Kotlin/JS projects without additional configuration.



### Debug

Source maps are generated automatically for debugging the code using browser development tools.

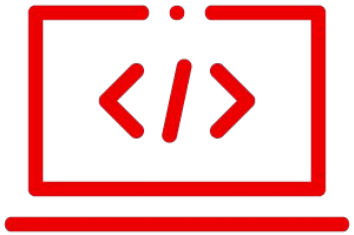
### Test

Run tests through a variety of test runners that can be specified via the Gradle configuration.
For advanced testing see https://kotest.io.

```
plugins {
    kotlin("js") version "1.4.30"
}

group = "com.redhat.kotlinjs"
version = "0.0.1"

dependencies {
    testImplementation(kotlin("test-js"))
}

kotlin {
    js {
        browser {
            testTask {
                useKarma {
                    useChromeHeadless()
                }
            }
            binaries.executable()
        }
    }
}
```

## Gradle Build Script

- Project coordinates
- Dependencies
- Run configuration

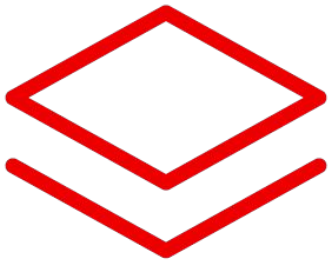


# getting-started

https://github.com/hpehl/kotlinjs-talk/tree/main/getting-started

# Kotlin Ecosystem

## Useful libraries for the JS platform



**kotlinx-html**
DSL for typesafe HTML

**kotlinx-serialization-json**
(De)serialize from / to JSON

**kotlinx-coroutines-core**
Concurrency in the browser

**ktor-client**
Fetch data from the backend

```
ul {
   listOf("Java", "Kotlin", "Scala").forEach {
       li {
           +it
       }
   }
}
```

```
<ul>
   <li>Java</li>
   <li>Kotlin</li>
   <li>Scala</li>
</ul>
```

## Typesafe HTML

Based on a DSL

Fully integrated

```
@Serializable
data class Todo(
    val id: Int,
    val name: String,
    val done: Boolean
)
```

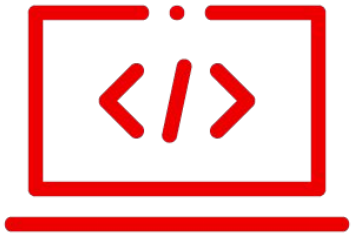
```
{
   "id": 23,
   "name": "Buy milk",
   "done": false
}
```

## Serialization

Reasonable defaults

Multiple formats

Annotation based

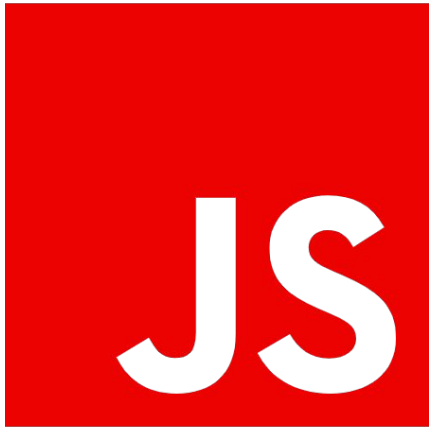


# ecosystem

https://github.com/hpehl/kotlinjs-talk/tree/main/ecosystem

# JavaScript Interop

## How to interact with the JavaScript ecosystem




**Browser & DOM API**

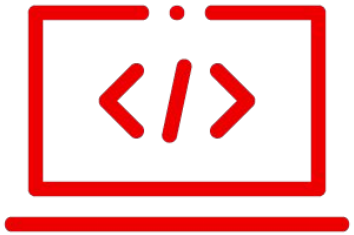
Typesafe wrappers for the DOM API

**Use JavaScript code**

Dynamic type, external declarations, Dukat

**NPM dependencies**

Managed by the gradle build script

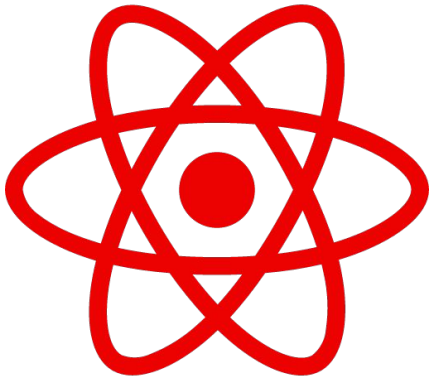


# jsinterop

https://github.com/hpehl/kotlinjs-talk/tree/main/jsinterop

# Kotlin/JS for React

## How to create own and use existing React components



**IDE Support**

Wizards to get started

**DSL**

Write typesafe HTML and CSS

**Components**

Create own and integrate existing components

```
external interface CounterProps : RProps {
    var step: Int
}

external interface CounterState : RState {
    var value: Int
}

class CounterComponent : RComponent<CounterProps, CounterState>() {

    override fun CounterState.init() { value = 0 }

    override fun RBuilder.render() {
        button {
            +"dec"
            attrs.onClickFunction = { setState { value -= props.step } }
        }
        +state.value.toString()
        button {
            +"inc"
            attrs.onClickFunction = { setState { value += props.step } }
        }
    }
}
```

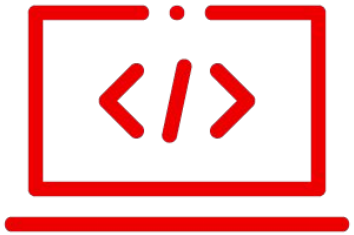
**Typesafe**

**React Component**

Properties

State

Component



`react`

https://github.com/hpehl/kotlinjs-talk/tree/main/react

# fritz2

## Reactive web-apps in pure Kotlin

**Pure Kotlin**

No external dependencies, just coroutines and flows

**Databinding**

No virtual DOM necessary

**Stores & Handlers**

Built around just a few basic concepts



fritz2 logo taken from https://github.com/jwstegemann/fritz2-web/blob/master/images/fritz2_logo_small_white.svg

```
class CounterStore(val step: Int) : RootStore<Int>(0) {
    val decrement: Handler<Unit> = handle { current -> current - step }
    val increment: Handler<Unit> = handle { current -> current + step }
}

fun RenderContext.counter(step: Int) {
    val store = CounterStore(step)
    div {
        button {
            +"dec"
            clicks handledBy store.decrement
        }
        store.data.asText()
        button {
            +"inc"
            clicks handledBy store.increment
        }
    }
}

fun main() {
    appendToBody(renderElement {
        counter(10)
    })
}
```

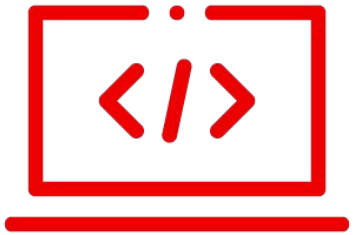


Fritz2

Store

Handler

Tags



# fritz2

https://github.com/hpehl/kotlinjs-talk/tree/main/fritz2

# PatternFly Fritz2

**PatternFly**

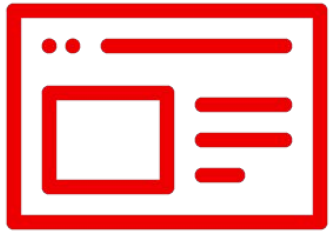
Open source design system using clear standards, components and layouts.

**Fritz2**

Reactive applications in pure Kotlin using coroutines and flows

**PatternFly Fritz2**

Implements PatternFly components using fritz2.



# PatternFly Fritz2 Showcase

https://patternfly-kotlin.github.io/patternfly-fritz2-showcase/#home

# Links

- Kotlin
- Kotlin/JS
- Slack Channel
- Playground
- React Hands-On
- PatternFly Fritz2
- Code Samples

# Thank you

Red Hat is the world's leading provider of enterprise open source software solutions. Award-winning support, training, and consulting services make Red Hat a trusted adviser to the Fortune 500.


linkedin.com/company/red-hat


youtube.com/user/RedHatVideos


facebook.com/redhatinc


twitter.com/RedHat



Red Hat