Jetbrains Compose

New GUIs for the desktop and beyond

07.07.2022, Java Forum Stuttgart, Germany
by Dr. Michael Paus

Background

About me

- Dr. Michael Paus
- Aerospace engineer from Stuttgart
- Developer, Consultant, Compose- and JavaFX-enthusiast
- OpenJFX author
- Chairman of the Java User Group Stuttgart e.V. (Organizers of the annual Java Forum Stuttgart)

The application

- Prototype of a General-Aviation flight planning software.
- Testbed for new concepts in flight management, data management and flight planning.
- Special version used by „Deutscher Aeroclub“ DAeC to validate airspace data.
- Mobile version for flight operation.
- Web version for community interaction.

Contents and Take-aways

Contents

- Provide basic facts about Compose.
- Show fundamental concept of Compose via a small example.
- Discuss potential issues about going multi-platform.

Take-aways

- A basic understanding of how Compose works.
- Some guidance on getting started.
- A few resources for further reading and experimentation.

Basic facts 1/2

	Compose
Introduction	Version 1.0 (for Android), July 2021 Version 1.0 (Multiplatform), December 2021 Version 1.2 will appear shortly
Main design concept	Composables (functions), observable state, magic :-) Similar to: SwiftUI, Flutter and React
Languages	Kotlin only (because of mandatory Kotlin compiler plugin)
Build tool	Gradle primarily (because of Gradle plugin) Maven can be used in a limited way without plugin too.
IDE support	Practically only IntelliJ/Android-Studio
Maintainers	Google, Jetbrains, Community contributions
Big users	Google (Android ...), Jetbrains (Toolbox ...), Twitter, ...

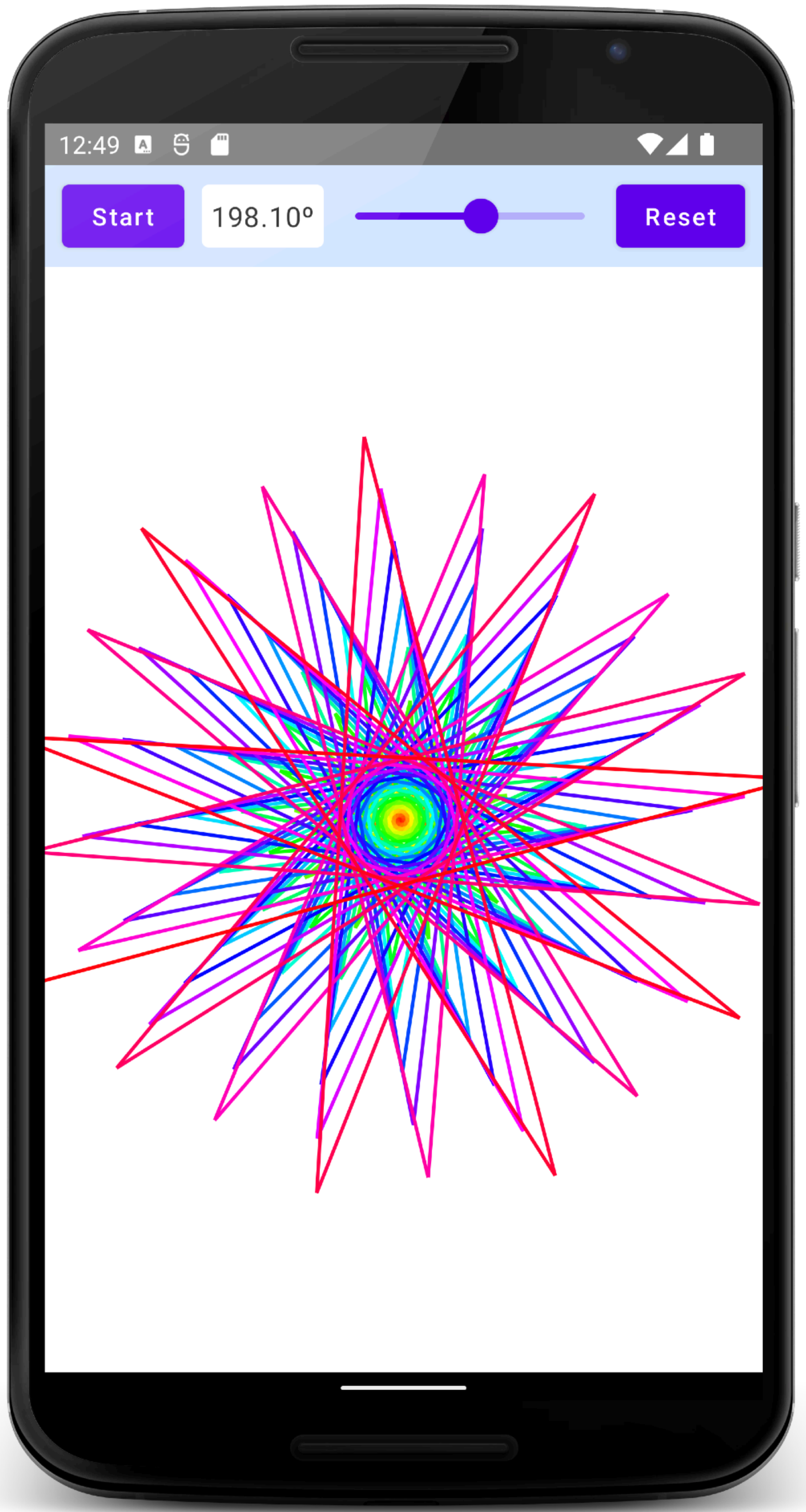
Basic facts 2/2

	Compose
Cross-Platform techn.	JVM, KMP bzw. KMM
Platforms	Windows, macOS, Linux (desktop) embedded (Raspberry Pi) Android (native), iOS (1. KMM + SwiftUI, 2. Canvas rendering in 1.2 dev builds already) Web on Client (1. DOM based, 2. Canvas rendering in 1.2 dev builds already)
License	Apache License 2.0
Sources	GitHub

Thinking in Compose

- Build your user interface by defining a set of composable functions that take in data and emit UI elements.
- Composable functions emit UI hierarchy by calling other composable functions.
- Composables are responsible for transforming the current application state into a UI every time the observable data updates.
- When the user interacts with the UI, the UI raises events such as onClick. When the state changes, the composable functions are called again with the new data.
- The Compose framework can intelligently recompose only the components that changed.
- Composable functions can be …
  … execute in any order and in parallel
  … skipped or canceled
  … and run quite frequently.

The PolySpiral example application



Common PolySpiral Model Code

```
data class PolySpiralManagerState (
    val isRendering       : Boolean = false,
    val delayMillis       : Long    = 40,
    val length            : Double  = 5.0,
    val lengthIncrement   : Double  = 3.0,
    val strokeWidth       : Double  = 2.0,
    val angleIncrementDeg : Double  = 0.0
)
```

Common PolySpiral Model Code

```
class PolySpiralManager(val coroutineScope: CoroutineScope) {
    private var timerJob: Job? = null

    private val _polySpiralManagerState = MutableStateFlow(PolySpiralManagerState())
    val polySpiralManagerState = _polySpiralManagerState.asStateFlow()

    […]

    fun startRendering() {
        if (isNotRendering) {
            timerJob = coroutineScope.launch {
                _polySpiralManagerState.update { s -> s.copy(isRendering = isRendering) }
                while (true) {
                    with (polySpiralManagerState.value) {
                        _polySpiralManagerState.update {
                            s -> s.copy(angleIncrementDeg = (angleIncrementDeg + 0.05) % 360.0) }
                        delay(delayMillis)
                    }
                }
            }
        }
    }

    […]

}
```

Compose GUI Code 1/2

```kotlin
@Composable
fun PolySpiralApp() {
    val coroutineScope = rememberCoroutineScope()
    val polySpiralManager = remember { PolySpiralManager(coroutineScope) }
    val polySpiralManagerState by polySpiralManager.polySpiralManagerState.collectAsState()
    val uiScale = LocalDensity.current.density

    Surface {
        Column(modifier = Modifier.fillMaxSize()) {
            Row(
                verticalAlignment = Alignment.CenterVertically,
                horizontalArrangement = Arrangement.spacedBy(10.dp),
                modifier = Modifier.
                    background(Color(210, 230, 255)).padding(start = 10.dp, top = 5.dp, end = 10.dp, bottom = 5.dp).fillMaxWidth()
            ) {
                Button(
                    onClick = { if (polySpiralManagerState.isRendering) polySpiralManager.stopRendering()
                                else polySpiralManager.startRendering() },
                    modifier = Modifier.width(70.dp)
                ) {
                    Text(text = if (polySpiralManagerState.isRendering) "Stop" else "Start")
                }

                Box(
                    contentAlignment = Alignment.Center,
                    modifier = Modifier
                        .size(70.dp, 36.dp)
                        .clip(RoundedCornerShape(4.dp))
                        .background(Color.White)
                ) {
                    Text(
                        text = "%.2fº".format(polySpiralManagerState.angleIncrementDeg)
                    )
                }
```

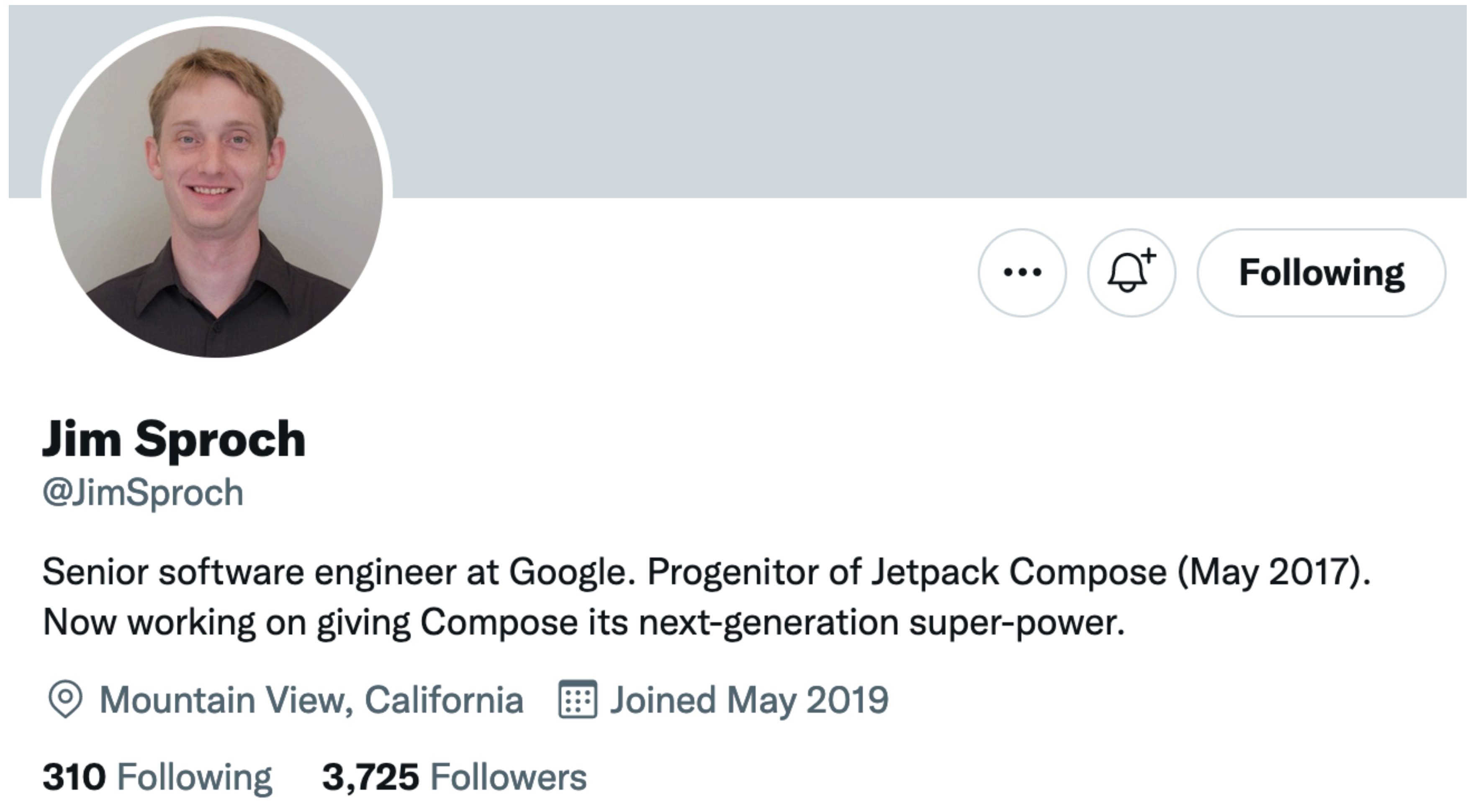
Compose GUI Code 2/2

```
                Slider(
                    value = polySpiralManagerState.angleIncrementDeg.toFloat(),
                    valueRange = 0f..360f,
                    onValueChange = { polySpiralManager.angleIncrementDeg = it.toDouble() },
                    modifier = Modifier.weight(1f)
                )

                Button(
                    onClick = { polySpiralManager.reset() },
                    modifier = Modifier
                ) {
                    Text(text = "Reset")
                }
            }

            Canvas(modifier = Modifier.fillMaxSize().clipToBounds().background(Color.White)) {
                with (polySpiralManagerState) {
                    drawSpiral(ComposeDrawScope(this@Canvas), length * uiScale, lengthIncrement * uiScale,
                        angleIncrementDeg, strokeWidth * uiScale)
                }
            }
        }
    }
}
```

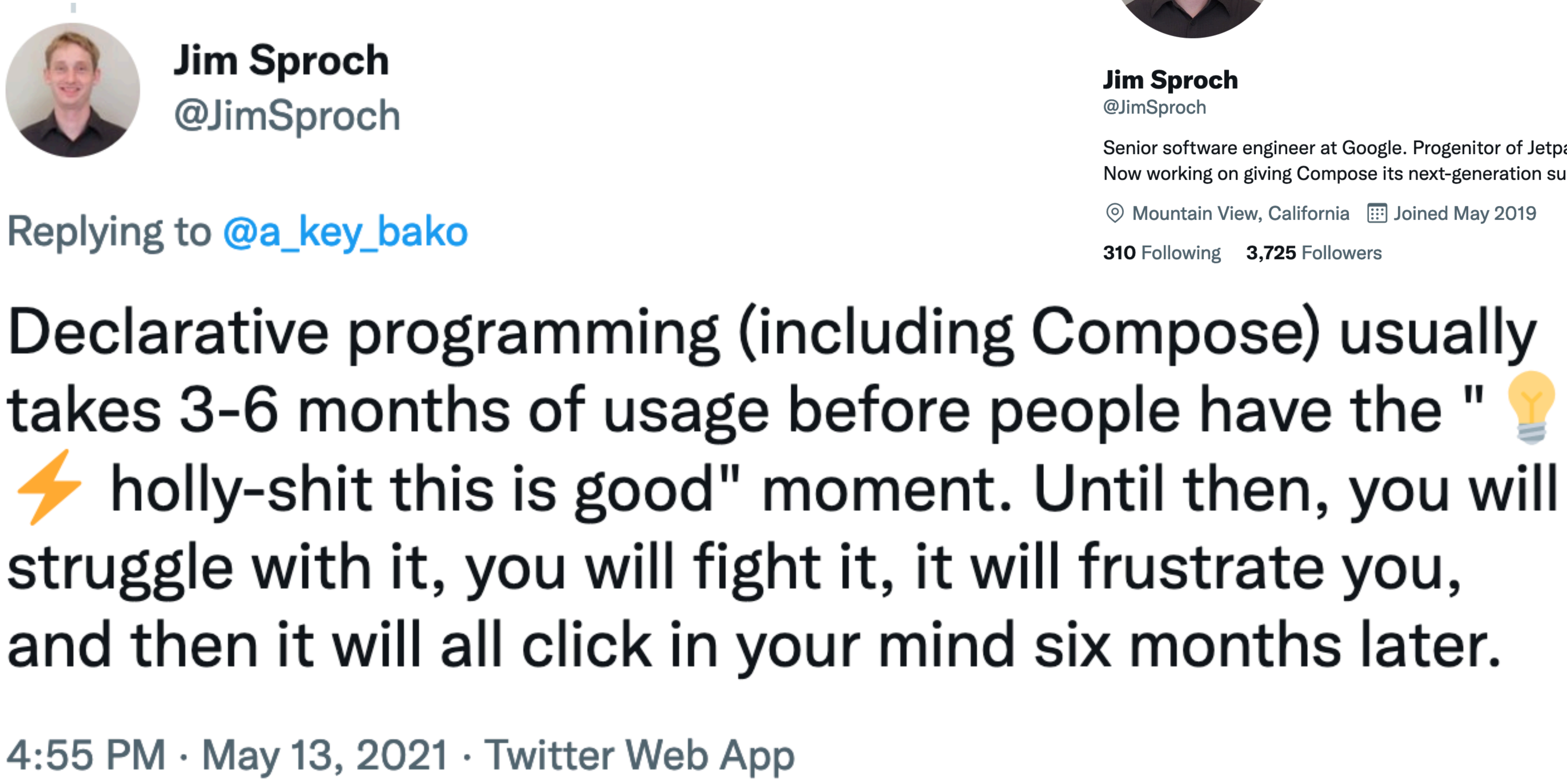
Compose GUI Code


Jim Sproch
@JimSproch

Senior software engineer at Google. Progenitor of Jetpack Compose (May 2017). Now working on giving Compose its next-generation super-power.

Mountain View, California Joined May 2019

310 Following **3,725** Followers

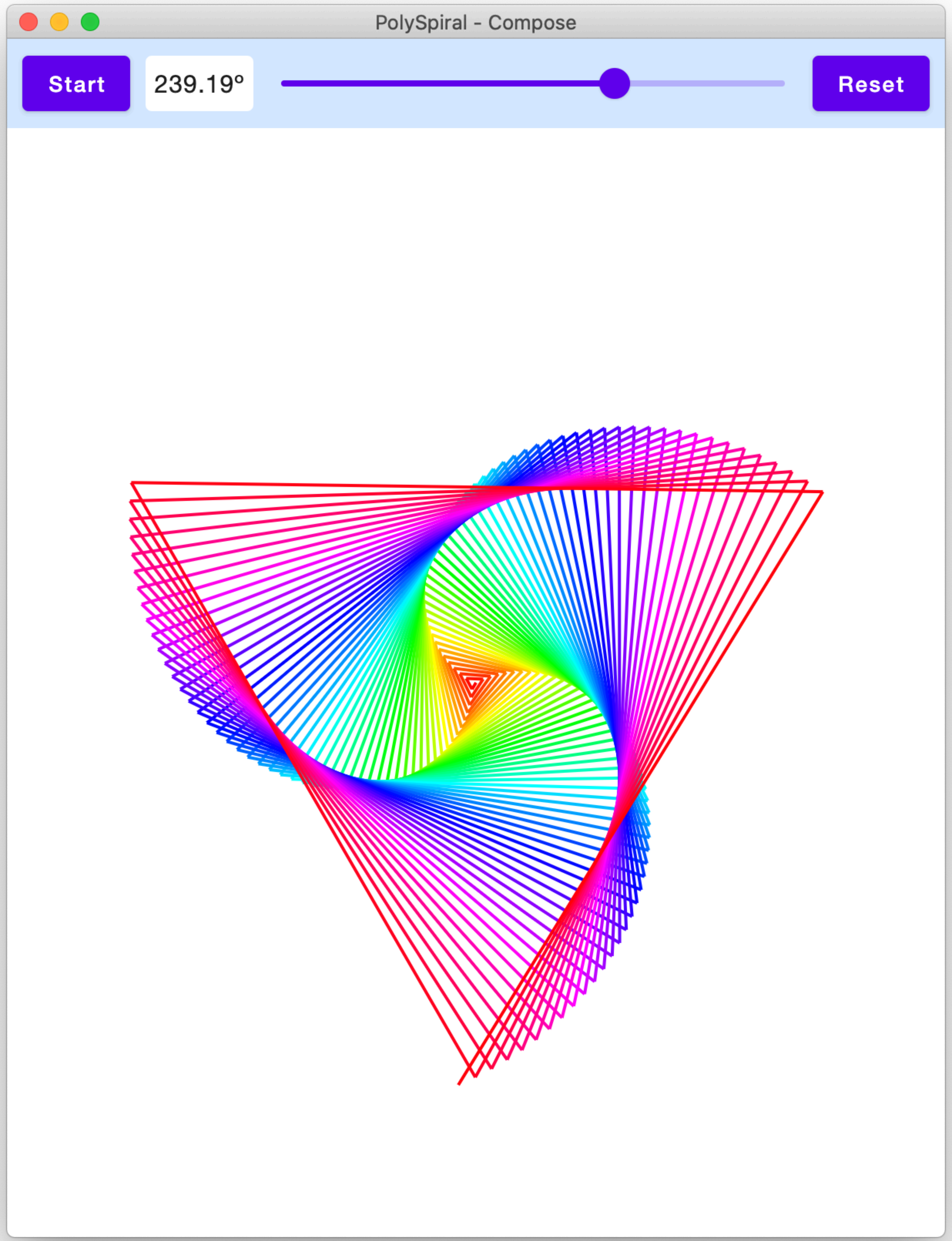

Jim Sproch
@JimSproch

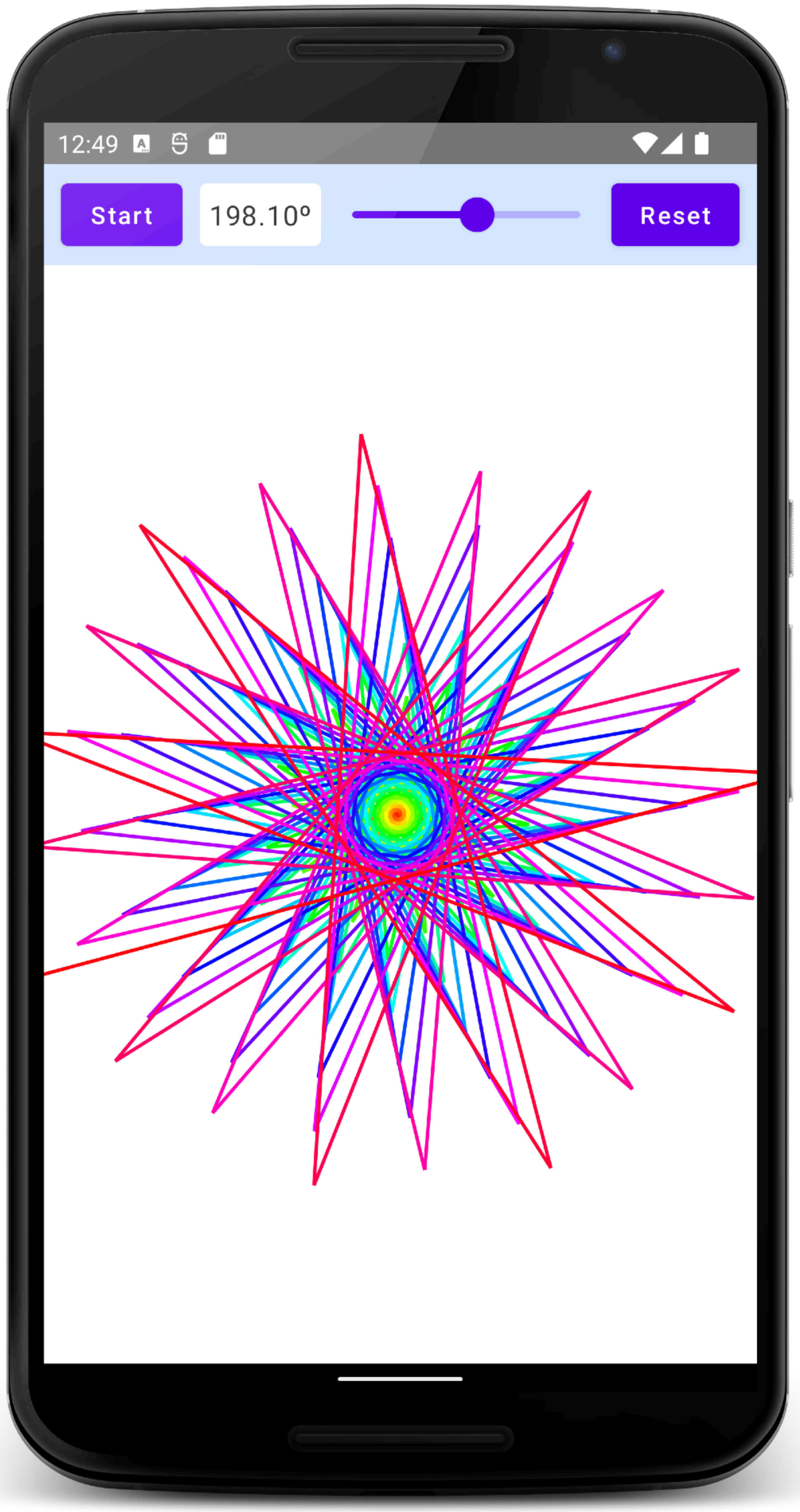
Replying to @a_key_bako

Declarative programming (including Compose) usually takes 3-6 months of usage before people have the " 💡⚡ holly-shit this is good" moment. Until then, you will struggle with it, you will fight it, it will frustrate you, and then it will all click in your mind six months later.

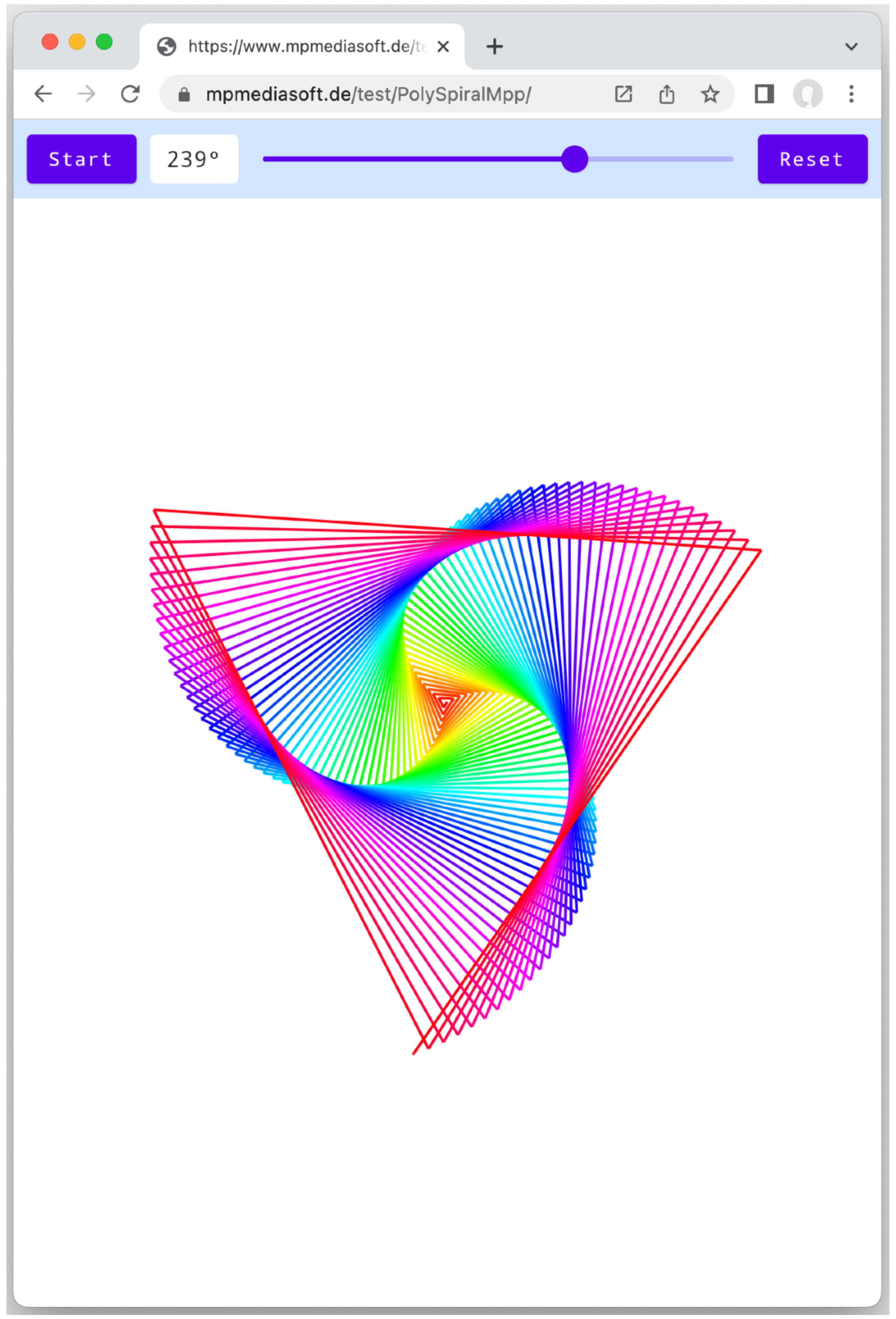
4:55 PM · May 13, 2021 · Twitter Web App

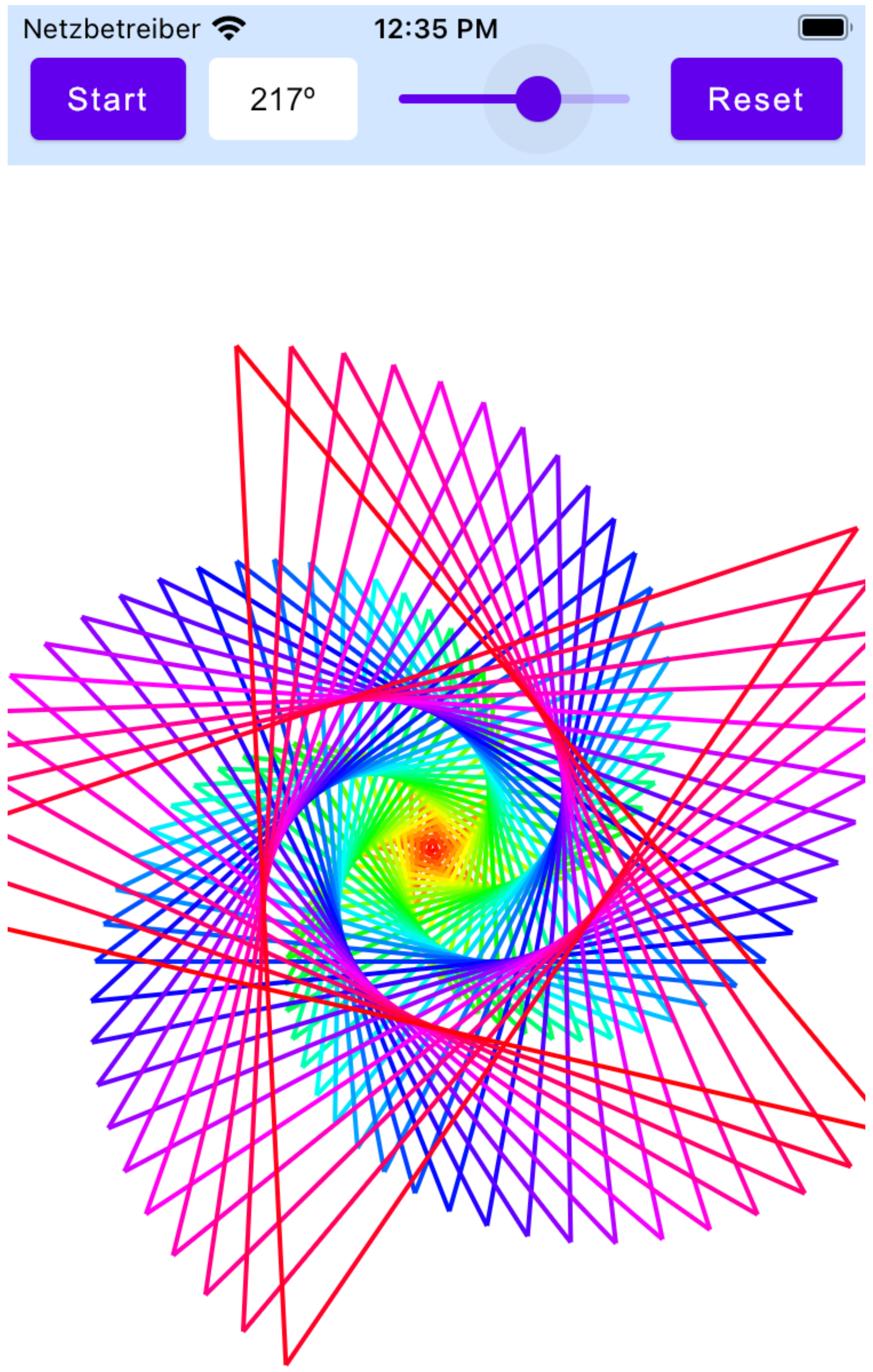
Compose Demo Desktop/Android





Compose Demo Web/iOS


https://www.mpmediasoft.de/t
mpmediasoft.de/test/PolySpiralMpp/
Start
239°
Reset

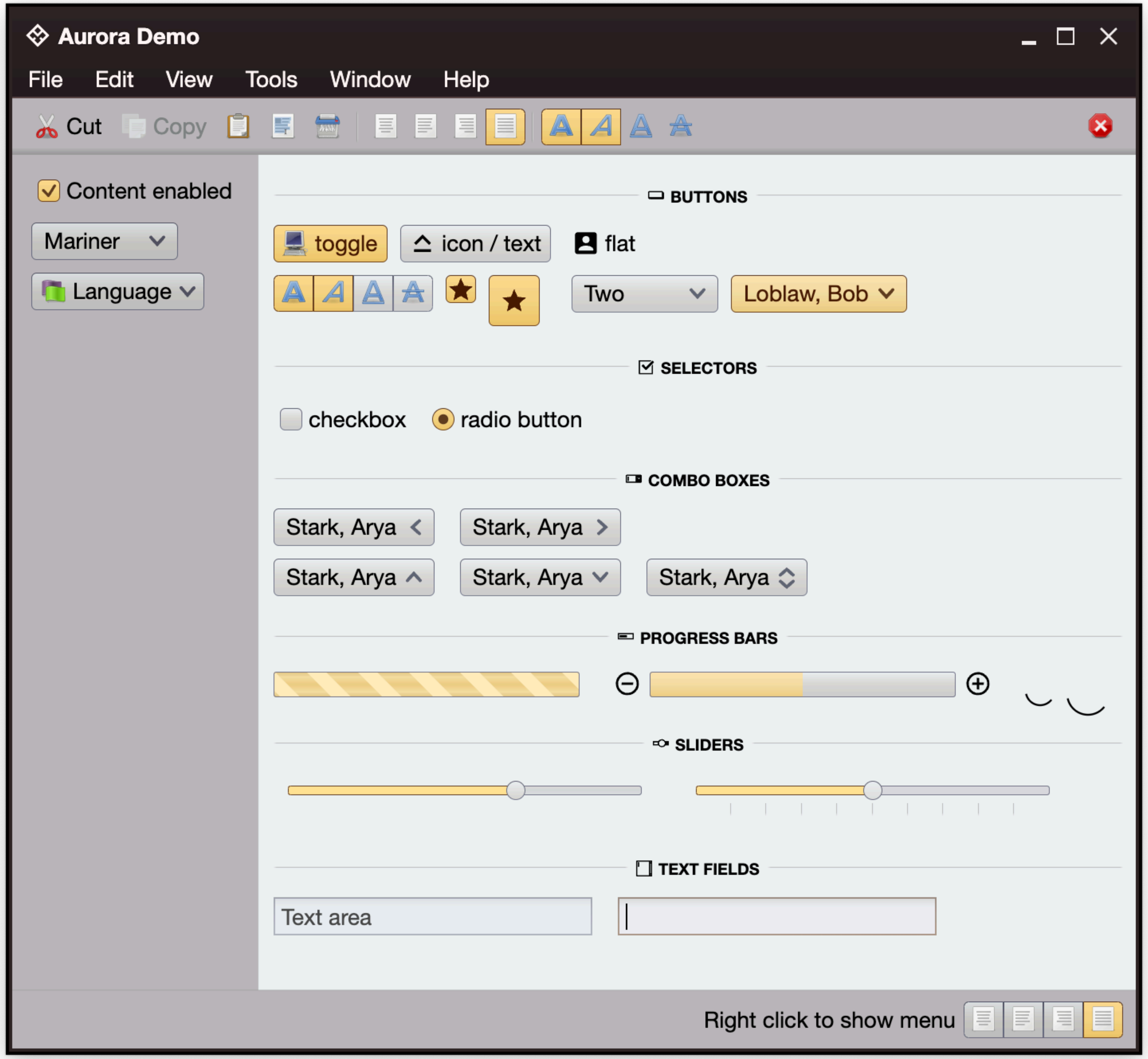


https://www.mpmediasoft.de/test/PolySpiralMpp/

Compose Aurora Demo Desktop

Completely restyled

by Kirill Grouchnikov, https://github.com/kirill-grouchnikov/aurora



- Googles MaterialTheme is default theme
  - Adjustable (colors, typography, shapes)
- Custom themes
  - Completely restylable (see Aurora)

https://developer.android.com/jetpack/compose/themes

How to start

- Single-platform or multi-platform (KMP/KMM)?
  - Single-platform easier to handle than multi-platform.
  - How to integrate Java code?
    - Automatic/manual conversion to Kotlin.
    - Direct use on JVM/Android. (Android mostly compatible with Java 11!)
    - Substitution via expect/actual in multi-platform.
    - Maybe compilation via GraalVM/native-image and re-import via expect/actual or use gRPC.
- Recommendation:
  - Start with single-platform or multi-platform limited to JVM/Android.

Documentation

- Most comprehensive documentation for Androids Jetpack Compose
  - https://developer.android.com/jetpack/compose/documentation
  - Difficult to distinguish Android specific parts from common Compose parts.
- Jetbrains Compose (multi-platform)
  - https://github.com/JetBrains/compose-jb
  - Important tutorials and examples for multiplatform specific concepts.
- Others
  - Stackoverflow (https://stackoverflow.com/questions/tagged/android-jetpack-compose+compose-desktop)
  - Slack (https://kotlinlang.slack.com, channels: compose, compose-desktop, compose-web, multiplatform)
  - Google (watch the time stamp!)

Staying platform independent 1/3

- Logging
  - Various alternatives, e.g., "io.github.microutils:kotlin-logging:2.1.21"
  - `private val log = KotlinLogging.logger {}`

- Navigation
  - Hot topic in Android world. Not really needed for desktop.
  - Avoid Compose Navigation because it is Android specific.
  - https://arkivanov.github.io/Decompose/ (interesting but complex)
  - https://github.com/adrielcafe/voyager (lightweight)

Staying platform independent 2/3

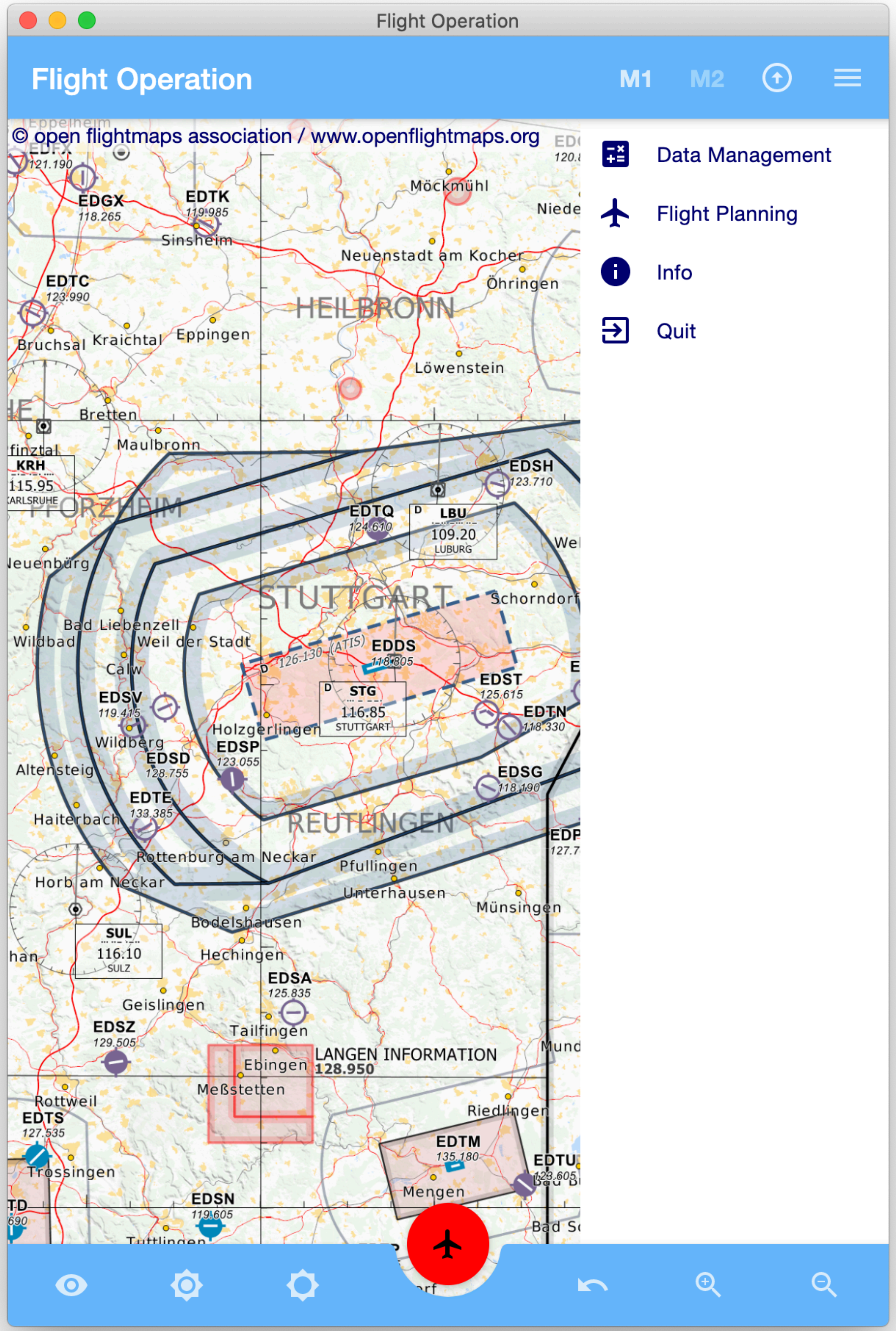
- Model - Runtime
  - Avoid ViewModel and LiveData because they are Android specific.
  - https://twitter.com/search?q=%20(from%3AJimSproch)%20ViewModel&src=typed_query&f=top
  - https://developer.android.com/guide/topics/resources/runtime-changes
  - Use coroutines and StateFlow as in example.
  - https://developer.android.com/kotlin/flow
  - https://medium.com/androiddevelopers/migrating-from-livedata-to-kotlins-flow-379292f419fb

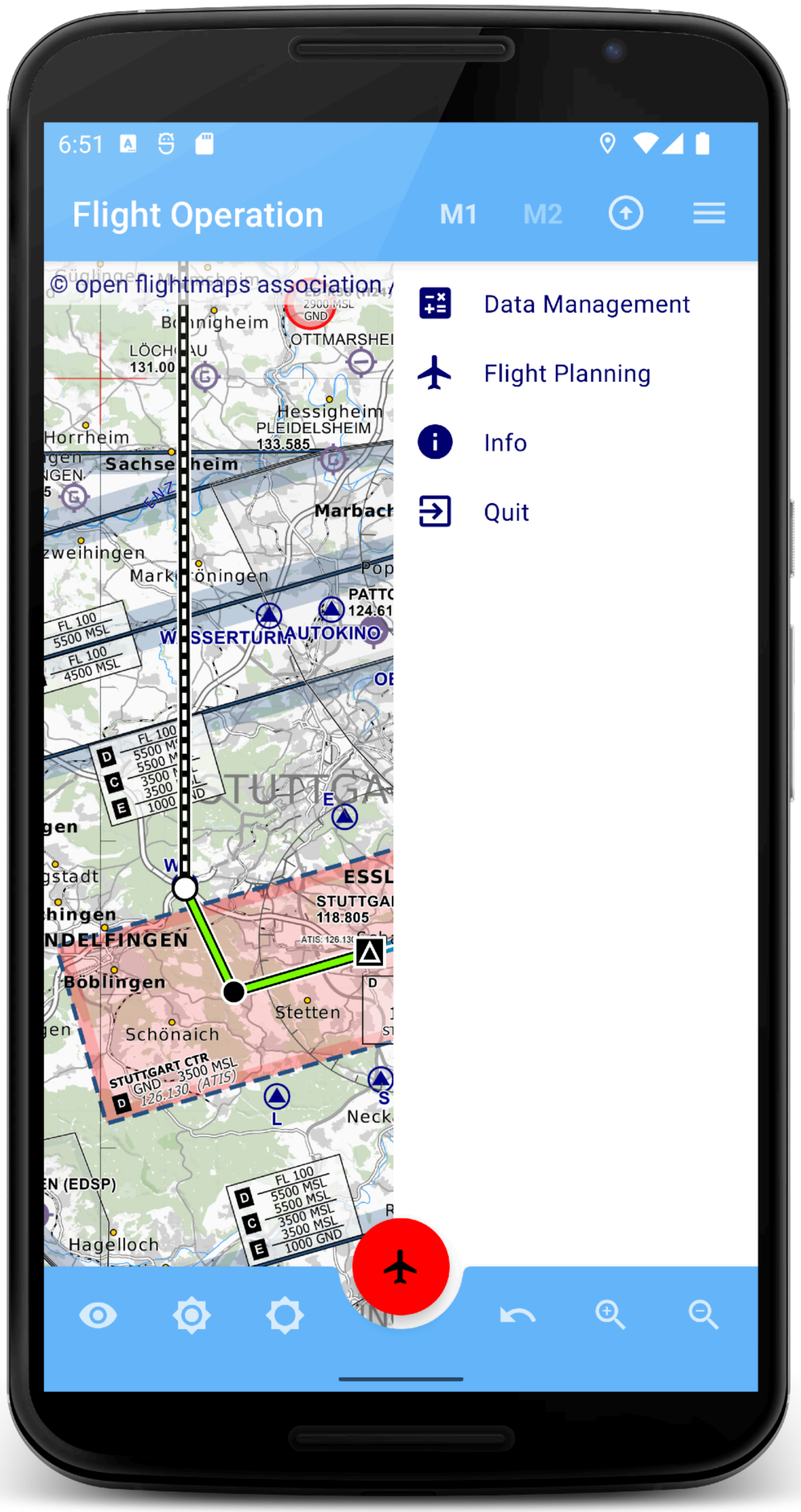
```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android" package="de.mpmediasoft.mpcopilot.android">
    …
    <application
            …
            <activity
                  …
             android:configChanges="colorMode|density|fontScale|keyboard|keyboardHidden|layoutDirection|locale|mcc|mnc|navigation|orientation|screenLayout|
screenSize|smallestScreenSize|touchscreen|uiMode">
           …
       </activity>
    </application>
</manifest>
```

Staying platform independent 3/3

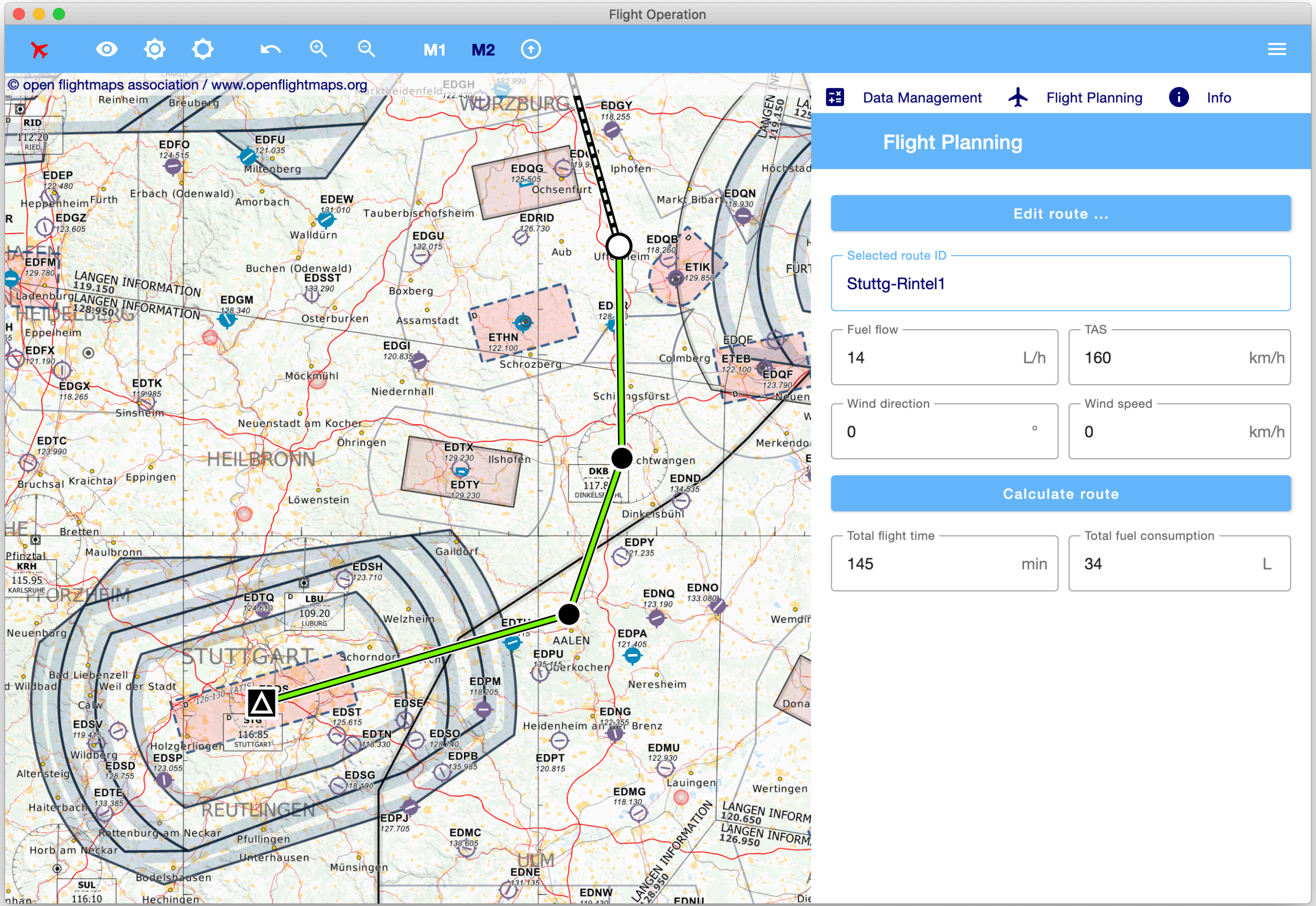
- Model - Persistence
  - Avoid Room because it is Android specific.
  - Use SQLite directly via JDBC or more elegantly via SQLDelight
  - https://github.com/xerial/sqlite-jdbc (Desktop), https://github.com/SQLDroid/SQLDroid (Android)
  - https://cashapp.github.io/sqldelight/ (Multiplatform)

Compose mpCoPilot Desktop/Android 1/2





Compose mpCoPilot Desktop/Android 2/2



Flight Planning

Selected route ID: Stuttg-Rintel1

Fuel flow: 14 L/h

TAS: 160 km/h

Wind direction: 0 °

Wind speed: 0 km/h

Total flight time: 145 min

Total fuel consumption: 34 L

Conclusions

- Compose is a powerful new GUI framework.
- Very mature for its age.
- Needs better Java integration in the multi-platform context.
- Tooling very consistent and complete but has to catch up with the fast development.
- It is fun to use and it is also very productive.
- Don’t get frustrated and give up too early :-)

Links

- https://blog.jetbrains.com/kotlin/2021/08/compose-multiplatform-goes-alpha/
- https://blog.jetbrains.com/kotlin/2021/12/compose-multiplatform-1-0-is-going-live/
- https://developer.android.com/jetpack/compose/mental-model
- https://www.jetbrains.com/lp/compose-desktop/
- https://github.com/mipastgt/JavaLandTalk2022
- https://github.com/mipastgt/JavaForumStuttgartTalk2022

Questions