



Vulkan on Android

Meet the speaker



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Why Vulkan on Android

Vulkan is the future

- Lower CPU overhead & power consumption
- Newer features for advanced GPUs
- Designed for modern hardware
- Modern API features like Multithreading

OpenGL ES (GLES) is the past

- High CPU overhead
- Is not getting new features

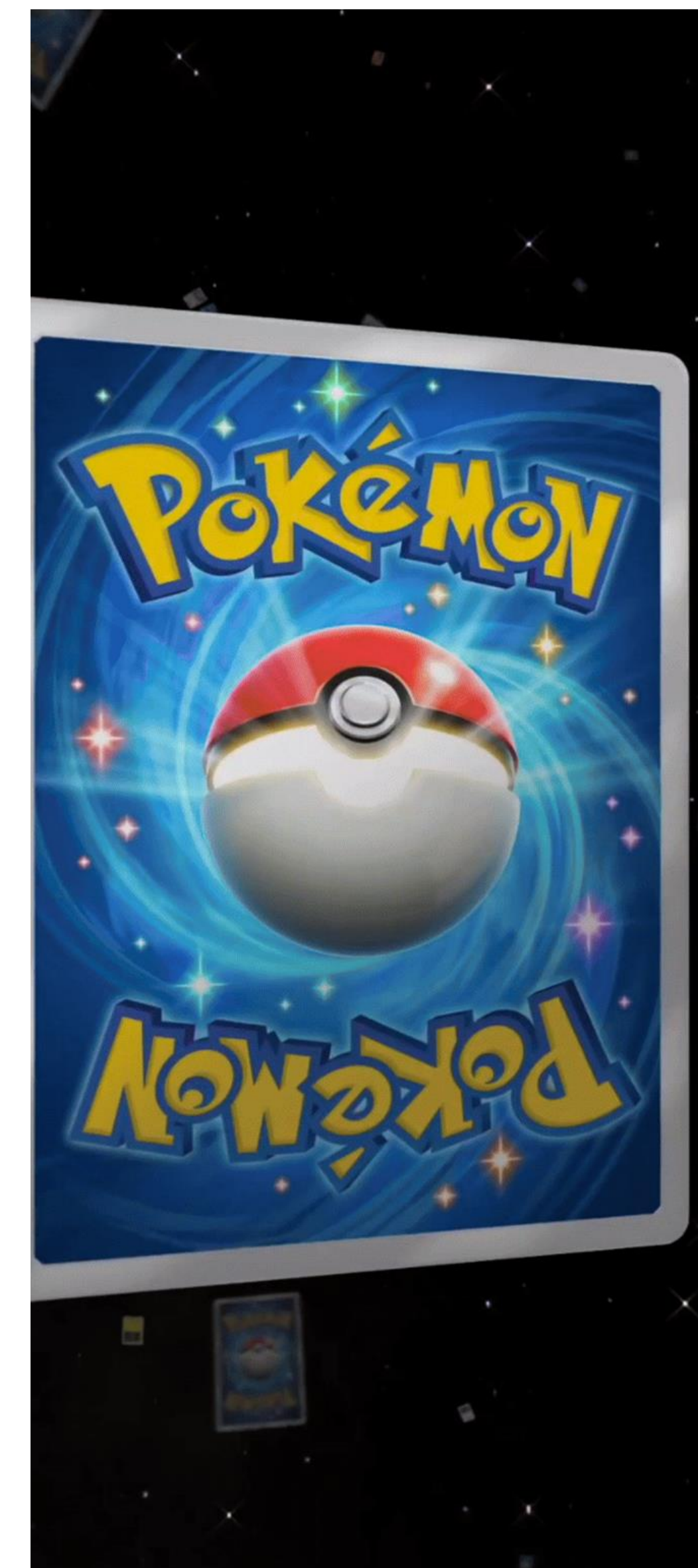


Developers benefit from VK

We've had substantial recent success with Vulkan:

- NetEase used Vulkan to implement ray tracing in Diablo Immortal, bringing their world to life with advanced visual effects
- Pokemon TCG used Vulkan to optimize graphics across a broad range of devices to ensure a smooth and engaging experience for every player
- Even games with less demanding graphics are seeing performance improvements from using Vulkan on Android like Warcraft Rumble and Family Island
- We've had a close collaboration with Game Engines such as Unity, and now over 40% of sessions from new Unity titles are using Vulkan, and we expect this number to grow rapidly*

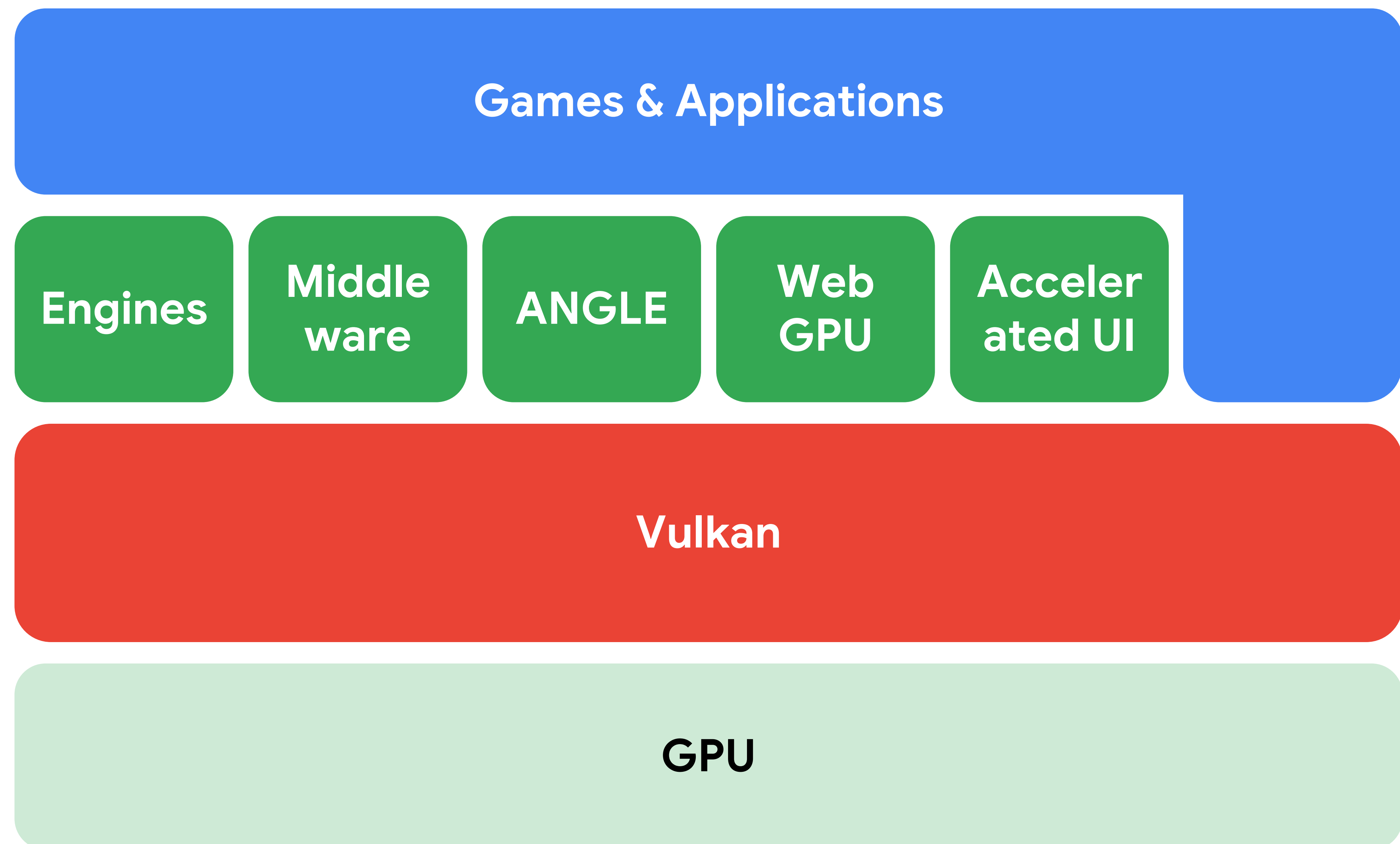
* Games on Android 14 launched between June, 2024 and December, 2024

The Vulkan logo, consisting of a red swoosh followed by the word "Vulkan" in a bold, red, sans-serif font, with a small trademark symbol (TM) to the right.

Android Vulkan Strategy

We're helping the industry focus on Vulkan by supporting all existing and future content on top of Vulkan

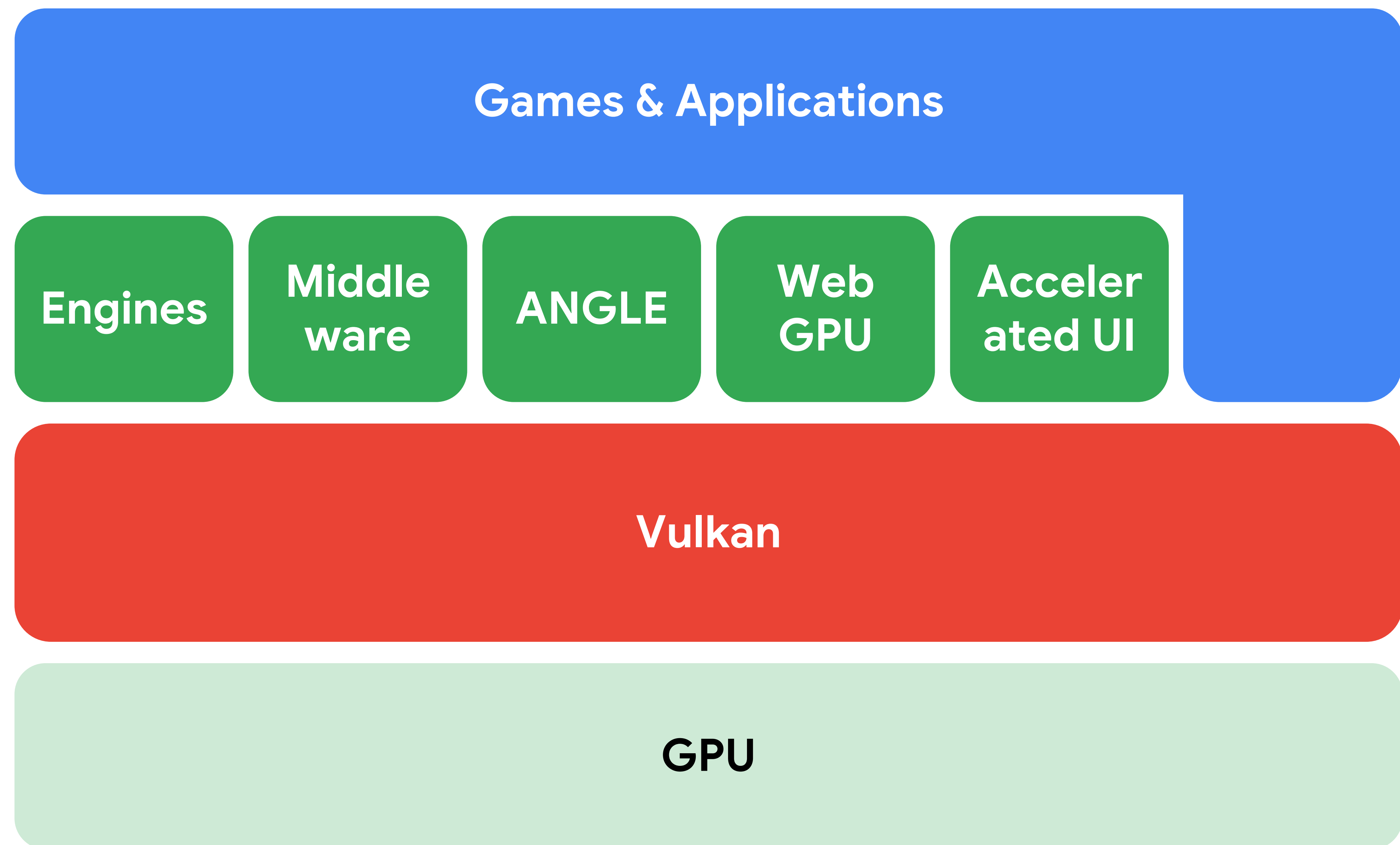
Provide Vulkan as the GPU HAL on Android



Android Vulkan Strategy

Everything works well on
top of Vulkan!

Provide Vulkan as the GPU HAL on Android



Android Vulkan Strategy

Everything works well on top of Vulkan!

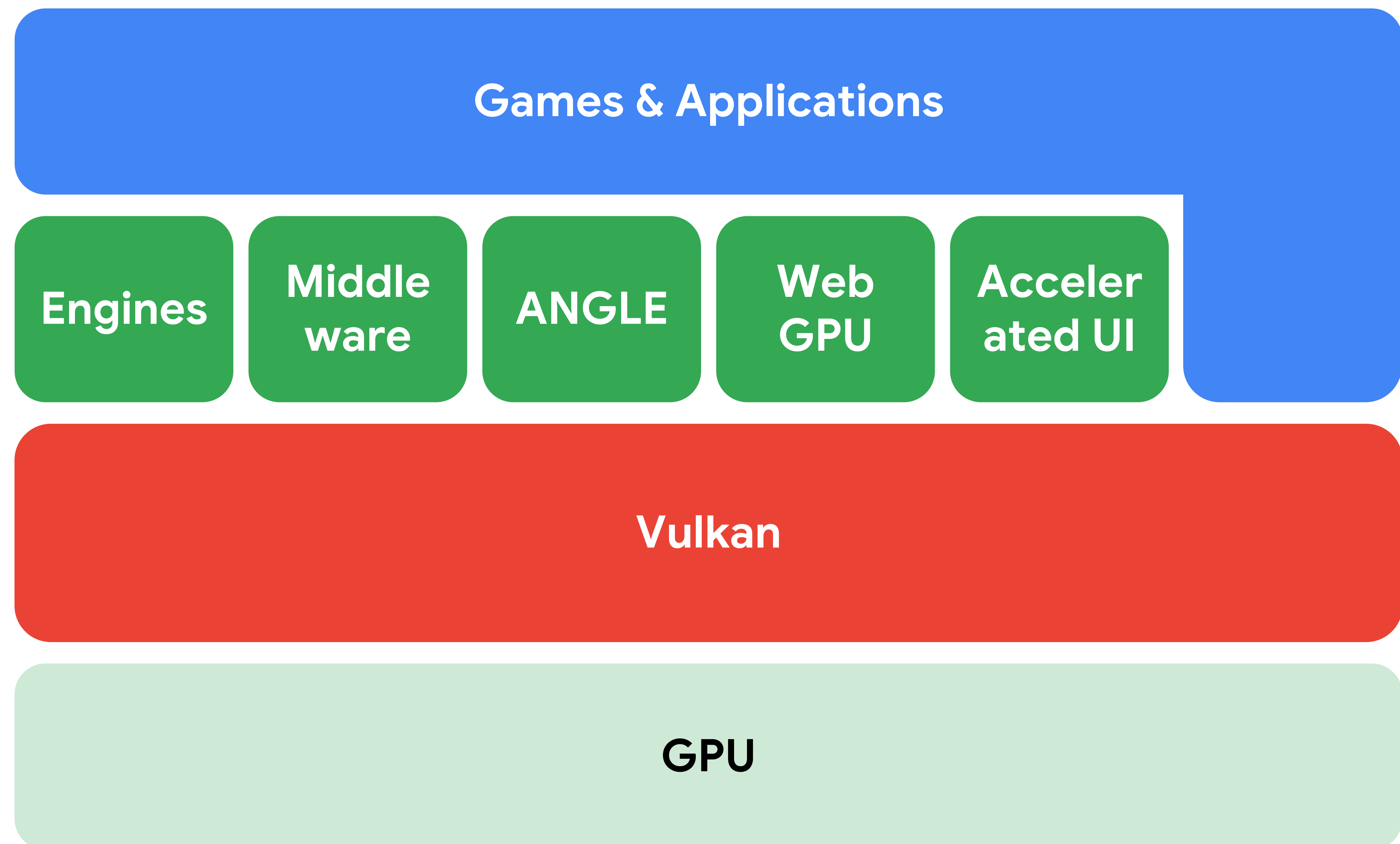
Some software will use Vulkan directly

Most will use Vulkan indirectly through:

- Game Engines
- Middleware
- Layered APIs such as:
 - Hardware Accel UIs (i.e. HWUI/Skia)
 - GLES compatibility via ANGLE
 - **New:** WebGPU C++/Java/Kotlin bindings for simpler apps/games

All existing OpenGL content will continue to work through layering

Provide Vulkan as the GPU HAL on Android



ANGLE

GL ES 3.2 Conformant layered implementation of OpenGL ES (GL ES) on top of Vulkan

Is the GL ES driver on some phones today

Will replace legacy GL ES drivers over time, e.g.

- Android 16 will require newer devices to use it for some applications
- Android 17 will require newer devices to use it for most applications

Focus ecosystem on just one HAL, while still running allowing older applications to still run



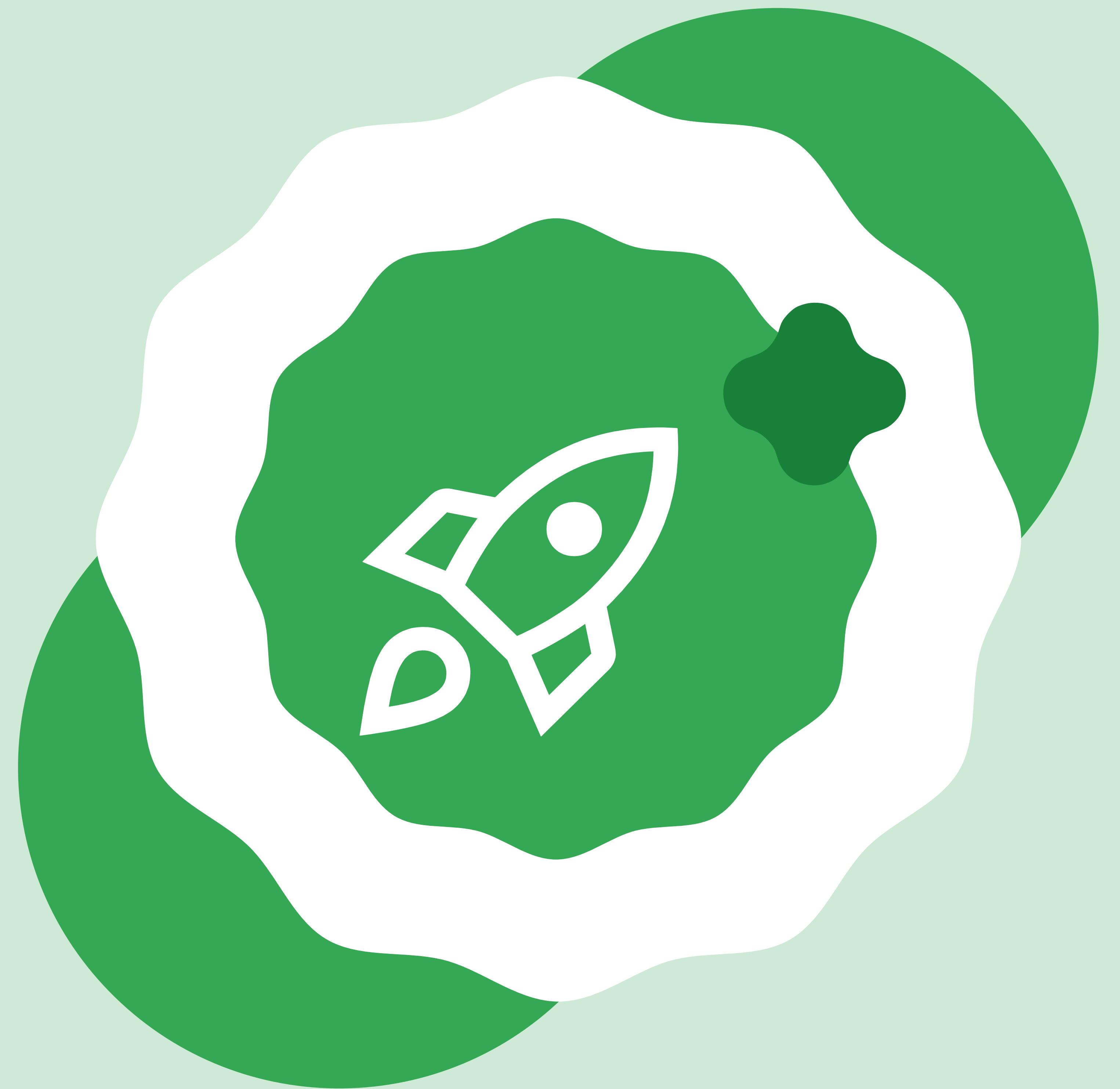
WebGPU

A higher level graphics language for app developers

App developers (especially those using Kotlin or Java) can't access Vulkan easily. We'll be encouraging them to use WebGPU to access the GPU on Android. WebGPU is a library that uses Vulkan and can be accessed directly from managed or native code.

It's available soon for developers to try out, and will be incorporated into the platform later in the year.

No immediate action is required. Although we encourage you to test WebGPU's performance on your Vulkan implementation.



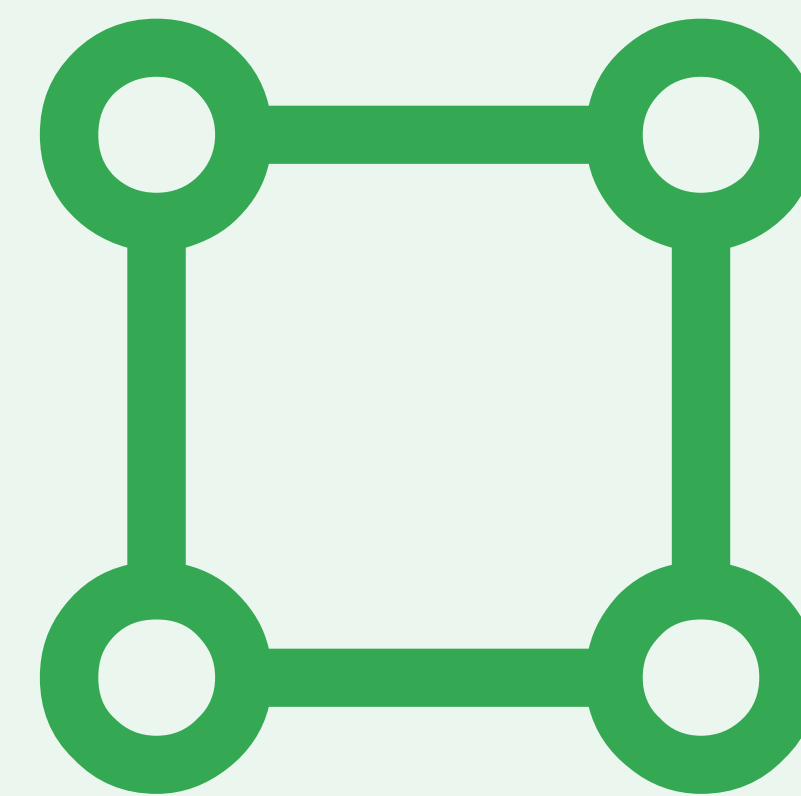
What Developers Need to Work Well **on Vulkan**



**Consistent
Features**



Engine support



**Correctness &
Stability**



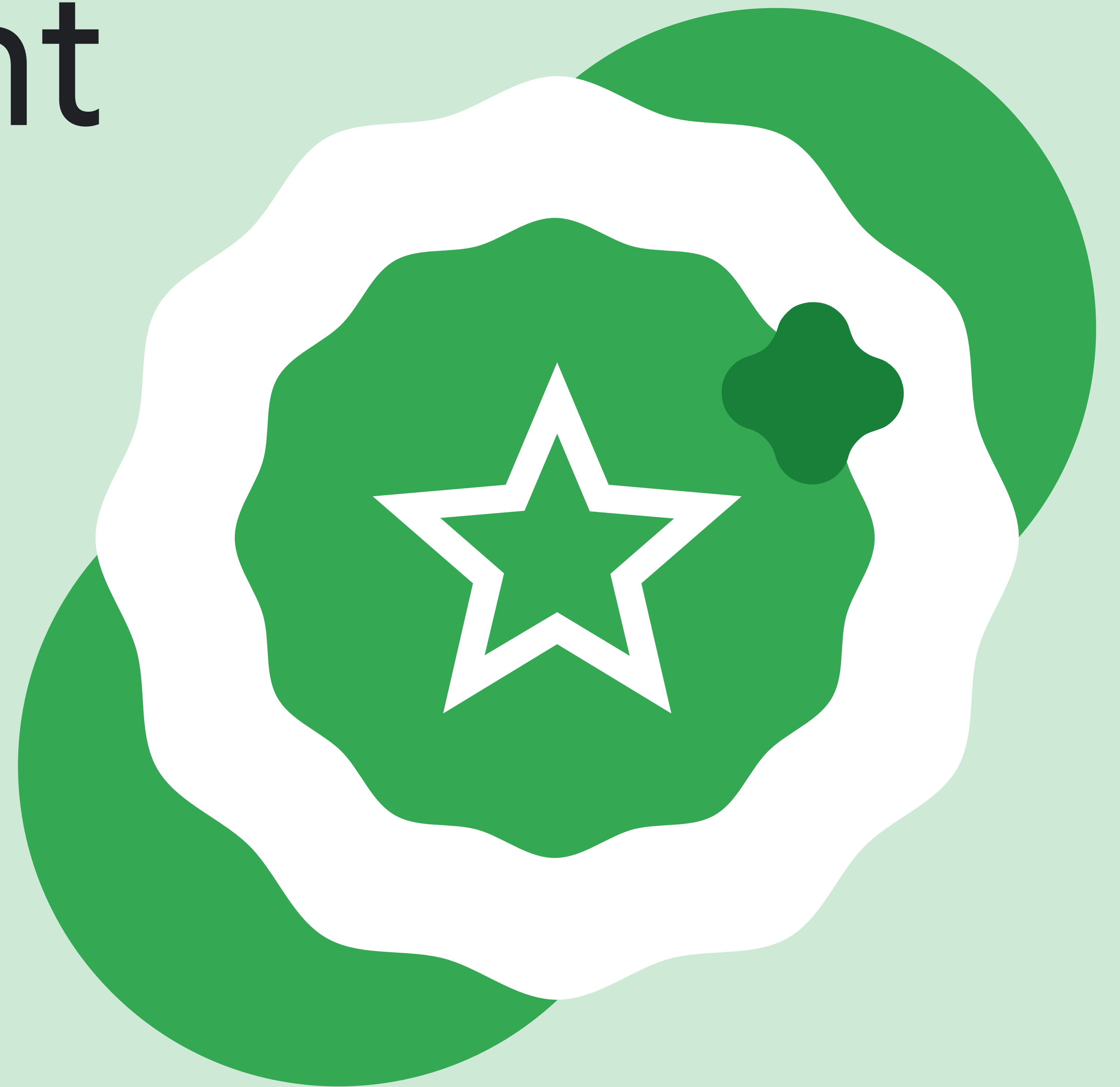
**No Performance
Surprises**

Getting Consistent Vulkan Features

More than 85% of active phones now support Vulkan

To help improve the consistency of phones across Android:

- Android Baseline Profiles set out the capabilities of most phones in the fleet
- Vulkan Profiles for Android mandate a minimum set of features
- Vulkan 1.4 will have a standard feature set



Android Baseline Profiles

[Android Baseline Profile 2021](#) (ABP 2021)

- What was available on 85+% of active devices at the end of 2021
- Vulkan 1.0 + additional extensions, features, formats, limits

[Android Baseline Profile 2022](#) (ABP 2022)

- What was available on 85+% of active devices at the end of 2022
- Vulkan 1.1 + additional extensions, features, formats, limits

ABP 2021 required for all phones and tablets on Android 14 and beyond

VSR Vulkan Profile Requirements **for Android 16**

Vulkan Profile for Android 16 (VPA16)

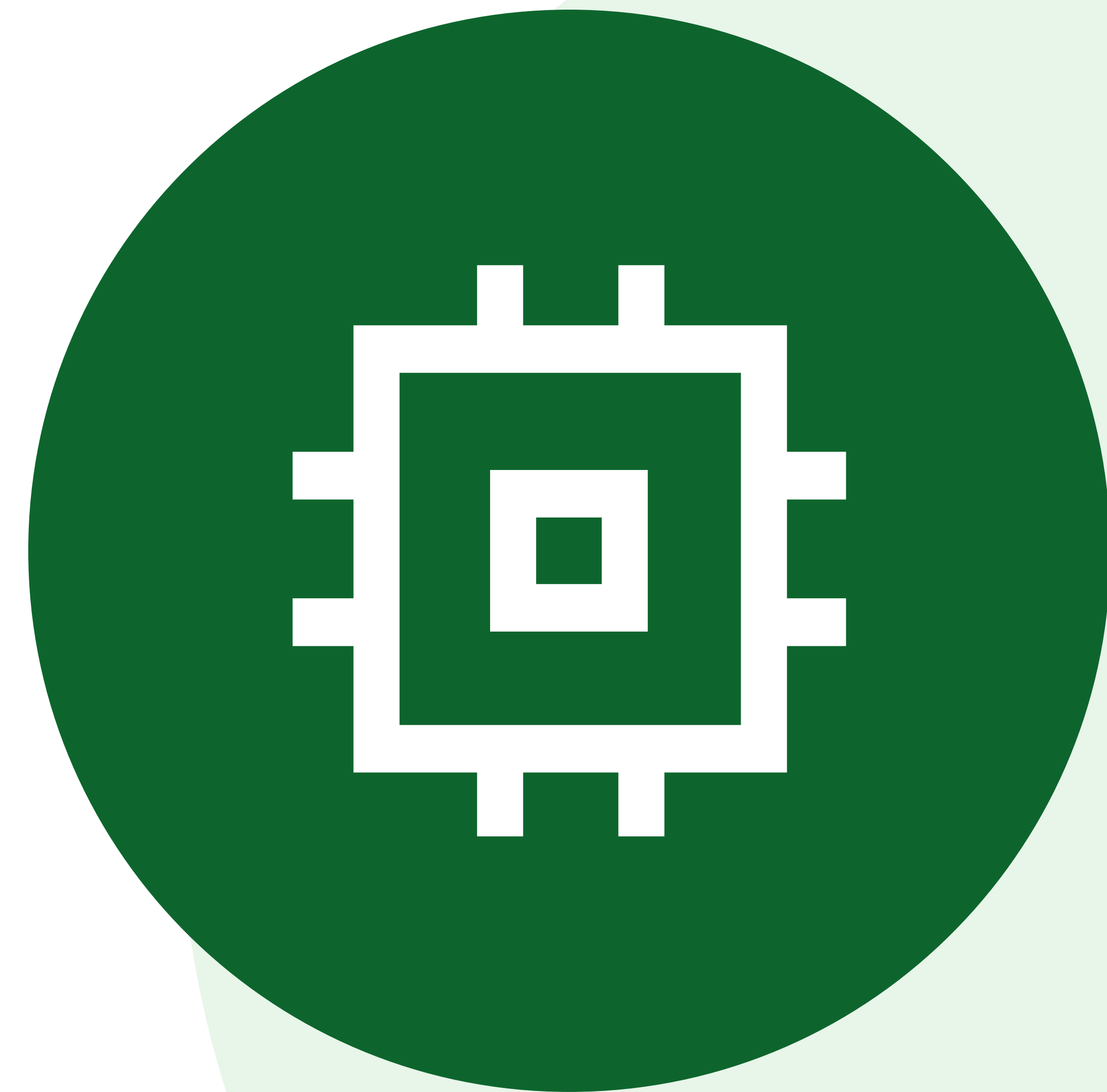
- Requires [VPA15](#) and [ABP 2022](#)
- Additional required Vulkan extensions, features, formats, limits needed by software developers
 - Tell us what you need and why, so we can advocate for you!
- That GPU vendors can deliver in time for Android 16

All of these profiles are required for new/renewing chipsets on Android 16

VPA Requires Newer GPUs

We want Vulkan applications to work well on Android

- Older GPUs don't provide all of the required Vulkan functionality
- Over time, older GPUs can't update to newer Android versions
- Eliminate reasons for software developers to target least common denominator functionality



Vulkan 1.4

Android helped define Vulkan 1.4 functionality

- Vulkan 1.4 is largely a subset of VPA16 (reflecting developer needs)
 - Removed some functionality that TV/Auto/etc GPUs can't do

Vulkan 1.4 is supported in Android 16

- The Vulkan loader has been updated to support loading Vulkan 1.4
- Vulkan 1.4 CTS/dEQP is now part of certification

Vulkan 1.4 will be a subset of VPA 17

- I.e. New SOC's must support Vulkan 1.4



Improving Engine support



Game engine support

We want game engines to work well on Vulkan

- We're working closely with the major 3p and 1p game engines to help them improve their Vulkan renderers
- We're collaborating on new higher fidelity features, as well as just general stability
- On most major game engines today, Vulkan is now on by default, as it is the more suitable backend.



De-risking using Vulkan

Active devices may be on an older version of Android

- Some don't have a high-quality Vulkan driver

We've been working with large engines

- Selection mechanism for which devices/releases to still use GLES on
- Denylist on newer Android versions
- Allowlist on older Android versions

Try out the allowlist today at:

<https://developer.android.com/games/engines/unity/unity-vkquality>



Getting Correctness, Stability & Updatability

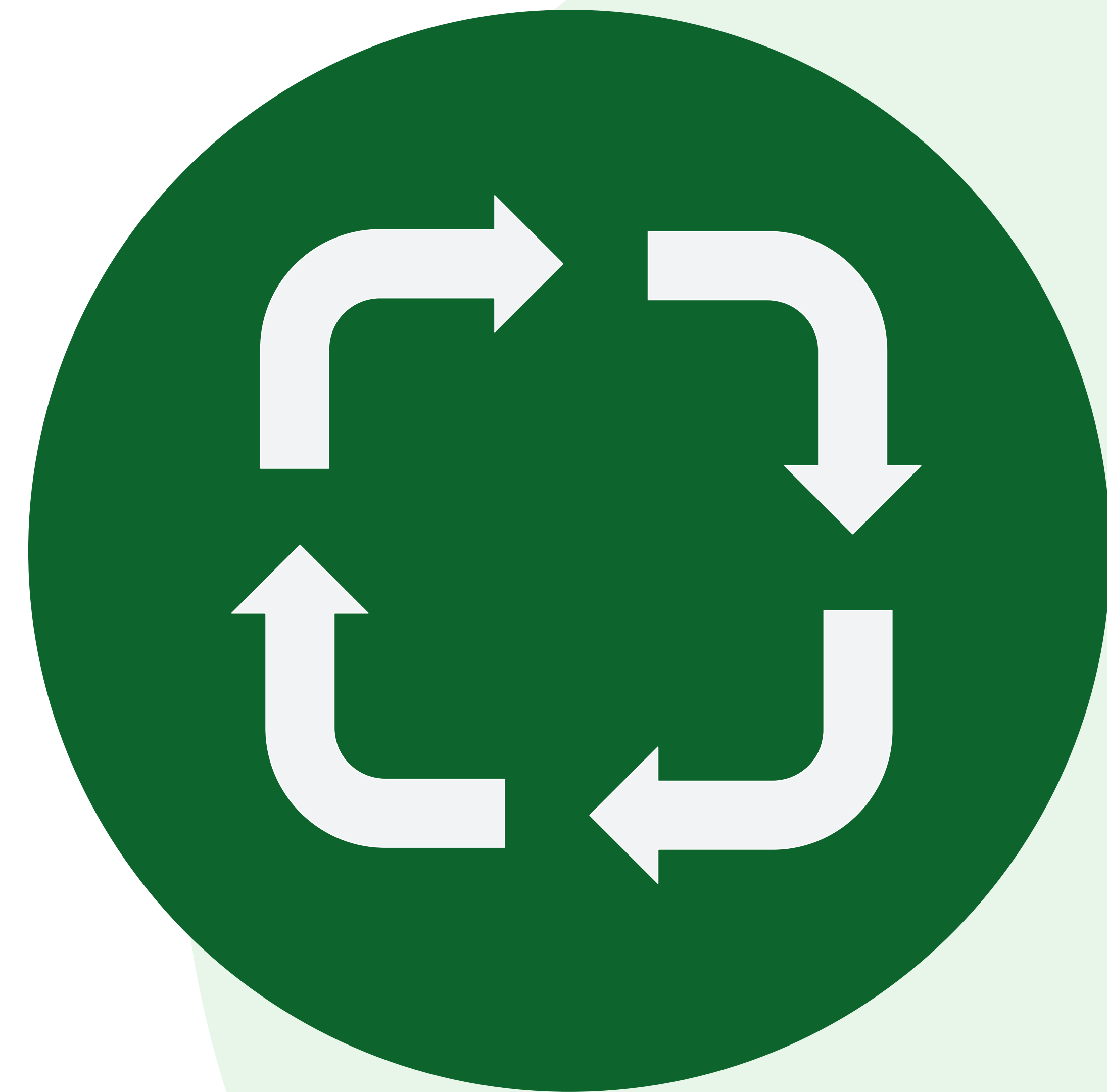


Improving Driver Quality

We are:

- Improving Vulkan testing
- Increasing our telemetry (crashes, LMKs)
- Working with game engine developers
- Working closely with our hardware partners
 - Connect developer-found defects
 - Get more frequent driver updates

If you find driver problems, please let us know. As they say here in the UK: **See it, Say it, Sorted**



Avoiding performance surprises

We're working on a new profiler with Samsung

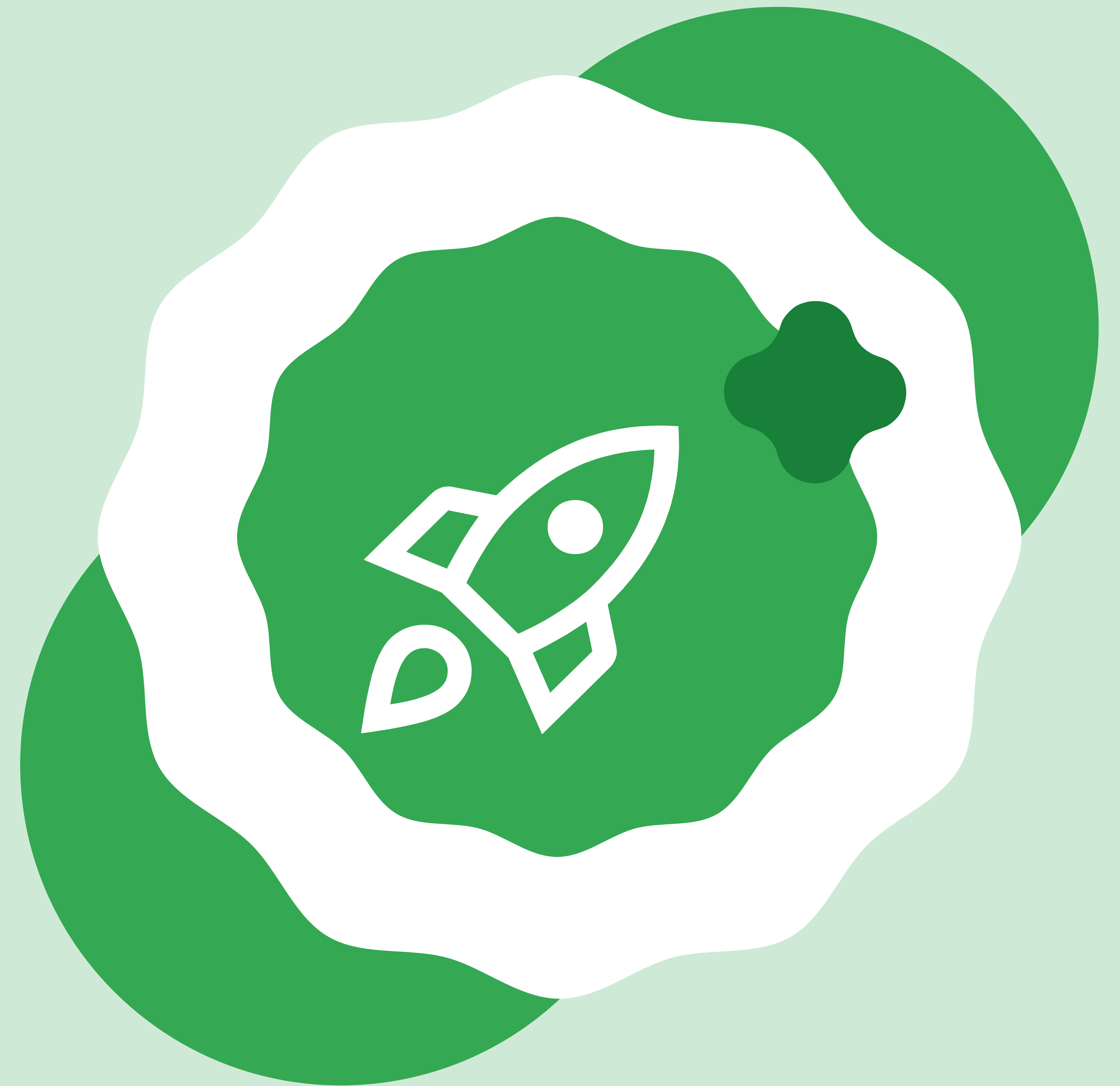
Stay for the next talk for more details!



Summary

- Vulkan offers a number of advantages to developers, such as performance, efficiency and fidelity benefits
- In the future, all content on Android will ultimately run through Android, either directly, through an engine, or through layering
- We're working to improve the consistency, engine support, stability and performance of Vulkan

Whether you work in Hardware or Software, we need your help to make the Vulkan ecosystem as great as it can be, so please get in touch with any feedback, bugs etc.



Questions





Thank You!