

Get the Most Out of Mobile with Vulkan in Unity

ARM

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Agenda

- The benefits of the Vulkan graphics API
 - Multi-threading
 - Multipass
 - Vulkan vs OpenGL ES with Sky Force Reloaded
- Mali Graphics Debugger (MGD)
 - Integration in Unity
 - Live demo
- Wrap up



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The benefits of the Vulkan graphics API

Multi-threading / multicore efficiency

- Multi-threading responsibility moved to application level
 - The application has better visibility
- Efficient utilization of multiprocessor architecture
 - Spread work out faster to multiple cores
 - Lower CPU load and energy consumption
 - Able to schedule and migrate tasks between ARM[®] big.LITTLE[™] cores according to the load

Multi-pass rendering

- Very performant in tiled GPUs such as ARM Mali GPUs
 - Each pixel in a sub-pass can access the result of the previous sub-pass
 - All data can be contained on the fast on-chip memory, saving bandwidth
- Example of use-cases:
 - Deferred rendering
 - Soft-particles
 - Tone-mapping

Vulkan benefits in Lofoten demo




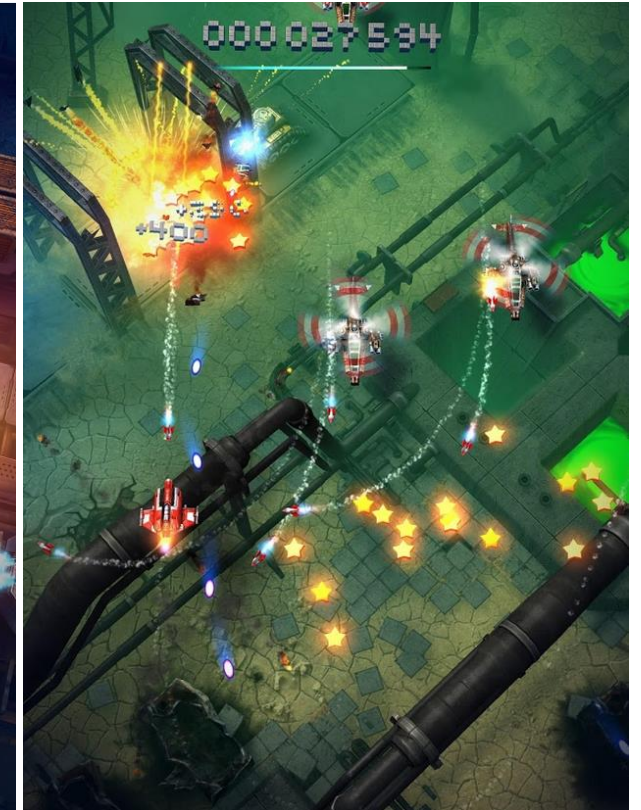
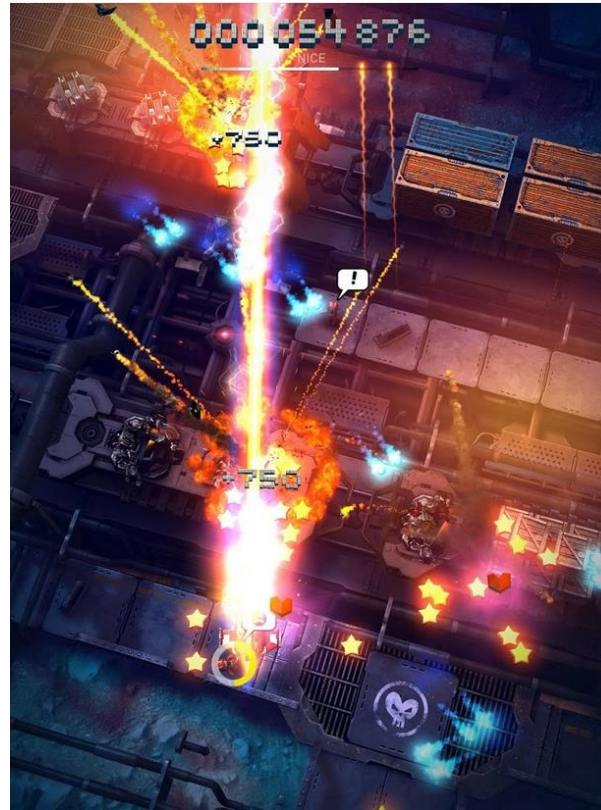
SCENE INFO

- ~ 100 lights with shadow maps
- 3M primitives (reduced to 500K with very efficient occlusion culling)
- 500 draw calls
- Sun light with cascade shadow map
- ~ 10 reflection probes
- FFT compute in ocean rendering
- Deferred shading using multi-pass
- 10x less load on CPU with multithreading

Sky Force Reloaded with Vulkan and Unity

What is Sky Force Reloaded?

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- Modern shoot'em experience
- Intense action, very rich graphics
- Pushing CPU and GPU to the limits



<https://www.youtube.com/watch?v=broXSmOMgxw>

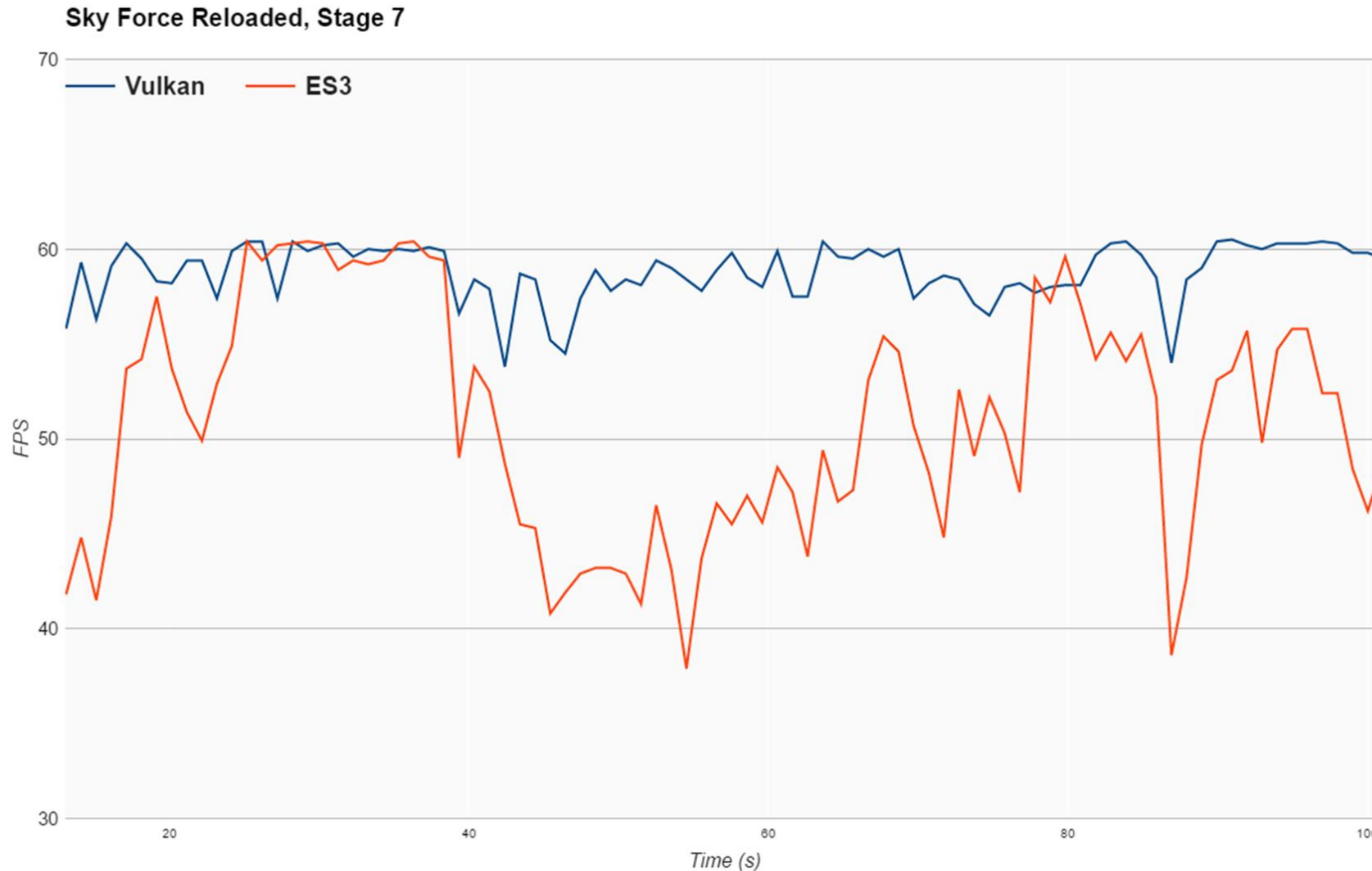
Performance issues in Sky Force Reloaded

- Performance issues on OpenGL ES
 - Even on high-end devices it was not possible to maintain 60 FPS all of the time
- Fill rate was not the bottleneck
- Up to 1000 draw calls per frame
- CPU was spending a lot of time preparing data for GPU

Performance benchmark

- Draw calls are expensive
- OpenGL ES driver is not optimal
- Perhaps Vulkan can help?
- Vulkan is supported by Unity!

Sky Force Reloaded: Vulkan vs OpenGL ES



Best case **21%** faster using Vulkan.

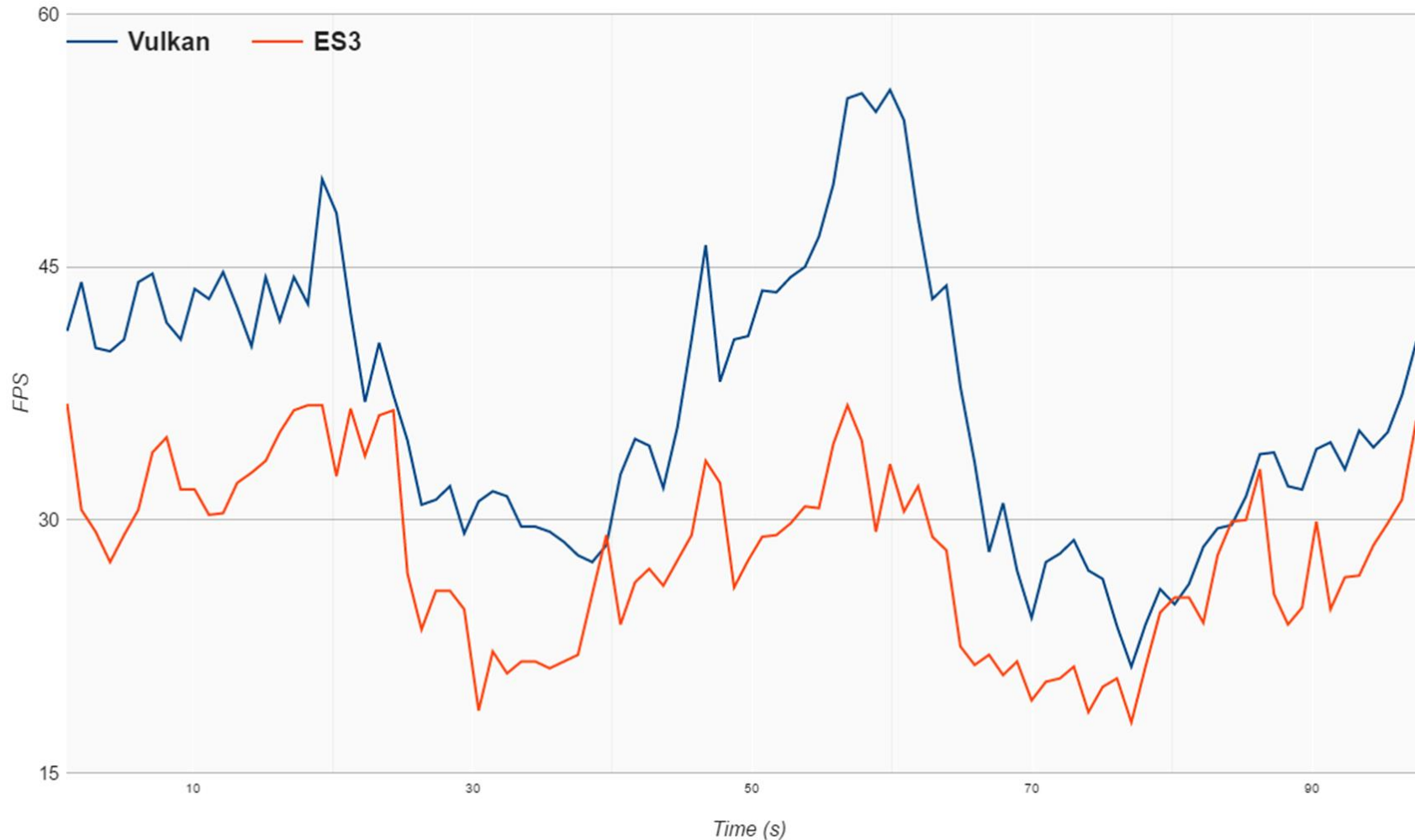
On average **15%** faster using Vulkan.



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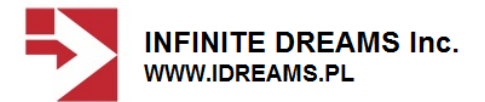
Sky Force Reloaded: Increased workload

Sky Force Reloaded, Stage 7, increased workload



Best case **82%** faster using Vulkan.

On average **32%** faster using Vulkan.



Extra power enabled by Vulkan

- More content
- Add more particle, objects or animations
- Keep the same FPS with richer graphics

<https://www.youtube.com/watch?v=VCSkp-QZ37M>

Power consumption test

- Power consumption is a **problem**
- Players were **not happy**
- Console-like quality games consume a lot of **power**
- Can **Vulkan** help?

<https://www.youtube.com/watch?v=Wl7nXq8oozw>

Power consumption test

- Vulkan consumed 10 to 12% **less power** in the game
- Majority of savings come from the **CPU**
- **Extra minutes** of playtime with Vulkan!

Summary

- **Great** to use “out of the box”
- **Improves** your FPS
- Adds some extra minutes of **playtime**
- You can add some **more graphics** and make your game look better

Mali Graphics Debugger (MGD) integration in Unity

Mali Graphics Debugger (MGD)

- **Draw-call by Draw-call stepping**
To identify draw call related issues, redundant draw calls and other opportunities to optimize
- **Texture View**
Visualize an application's texture usage, to identify opportunities to compress textures or change formats
- **Shader Statistics**
Understand which vertex and fragment shaders are the most expensive with cycle count reporting
- **Vertex Attribute / Uniform View**
See vertex data and index buffers
- **State View**
Full visibility of graphics state and tracking of state changes
- **Dynamic Optimization Advice**
Highlighting of common API misuse and dynamic performance improvement advice

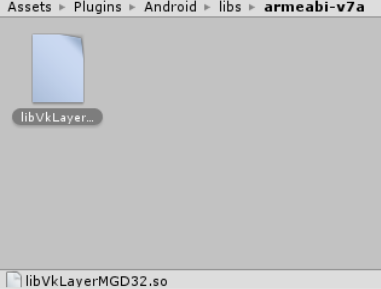


Download MGD for free at developer.arm.com

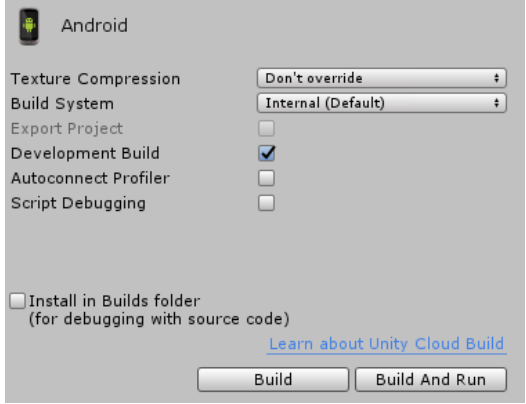
Mali Graphics Debugger

Vulkan

Assets/Plugins/Android/libs/armeabi-v7a/



libVkLayerMGD32.so



Android

Texture Compression: Don't override

Build System: Internal (Default)

Export Project:

Development Build:

Autoconnect Profiler:

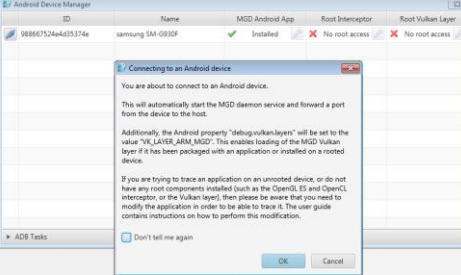
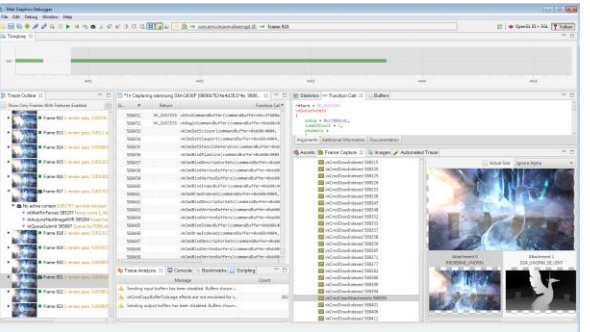
Script Debugging:

Install in Builds folder (for debugging with source code)

[Learn about Unity Cloud Build](#)

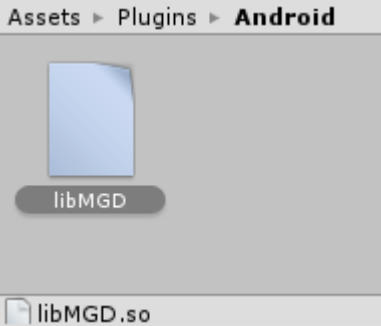
Build Build And Run

adb install -r MGD.apk

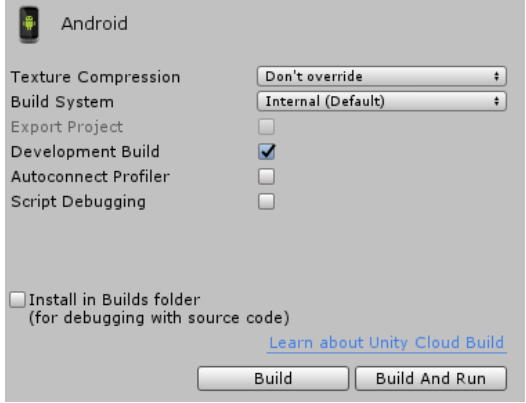



OpenGL ES

Assets/Plugins/Android



libMGD.so



Android

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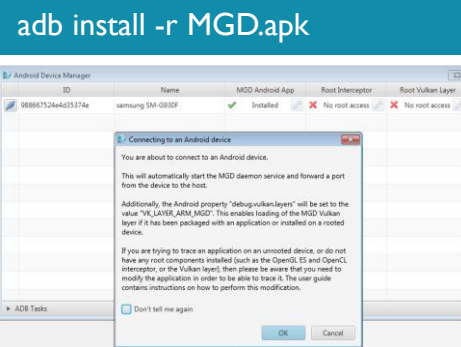
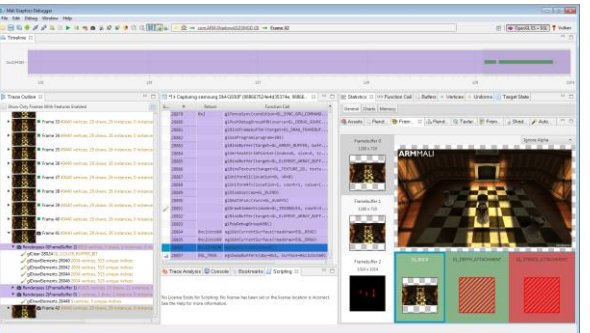
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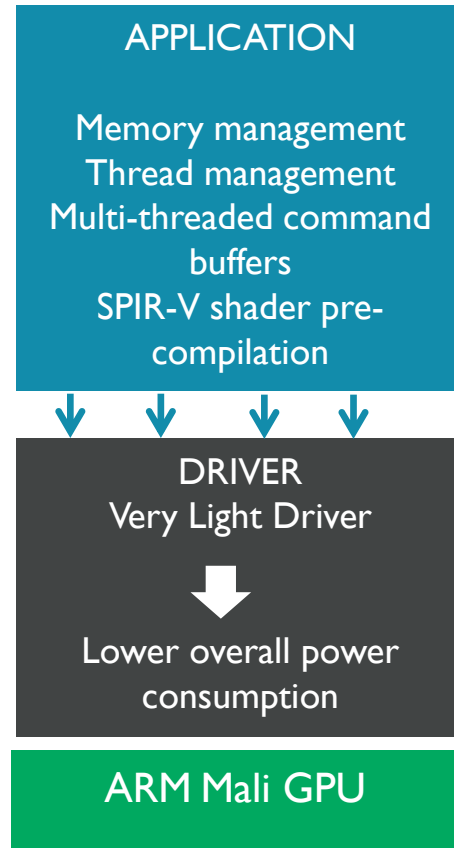
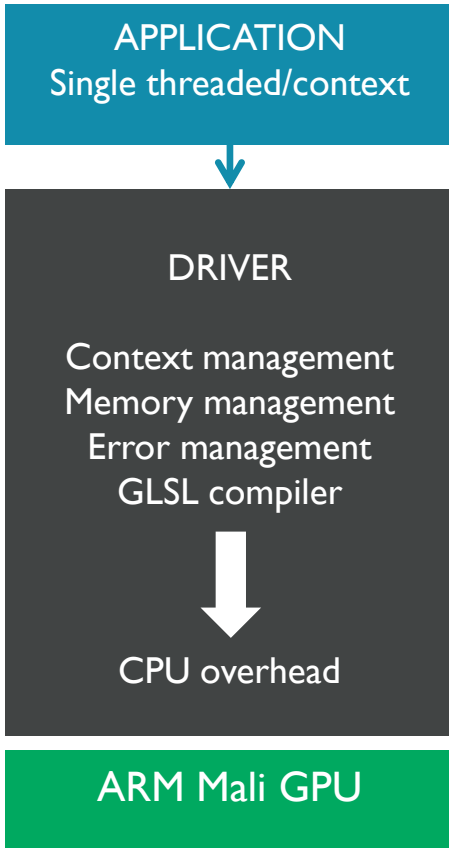
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Live demo: debugging Unity application with MGD

Wrap Up

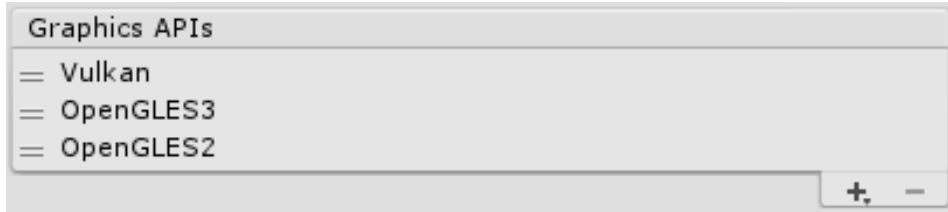


- ### VULKAN BENEFITS
- Portability across multiple platforms
 - Native thread friendly
 - Efficient utilization of multiprocessor architecture
 - Lower CPU load
 - Reduced energy consumption
 - Extra benefits for mobile platform and tiling architectures such as ARM Mali GPUs
 - Pixel access to result of previous sub-pass
 - Data contained on fast on-chip memory
 - Memory bandwidth saving
 - Loadable validation and debug layers

Mali Graphics Debugger

Takeaways

- ✓ Add Vulkan to the list of Graphics API – save performance, battery last longer



- ✓ Upgrade to Unity 5.6 – very easy to use MGD as it is integrated into Unity

Thank you

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Questions

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