# Raspberry Pi Vulkan Driver Update

X Developers Conference 2021

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# Contents

- 2020 recap
- 2021 status
- Performance
- Future Plans

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# 2020 recap

# 2020 recap

- Minimal Vulkan 1.0 feature set
- Not yet conformant
- Driver outside upstream mesa repositories
- Lack of real world testing

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# 2021 status

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# 2021 status

- Driver merged in upstream Mesa
- Upstream gitlab CI integration
- Vulkan 1.0 conformance

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# 2021 status

- Vulkan 1.1 feature set (not yet conformant)
- Additional extensions and features
- Better WSI platform support (Wayland,Display)
- Significant performance improvements

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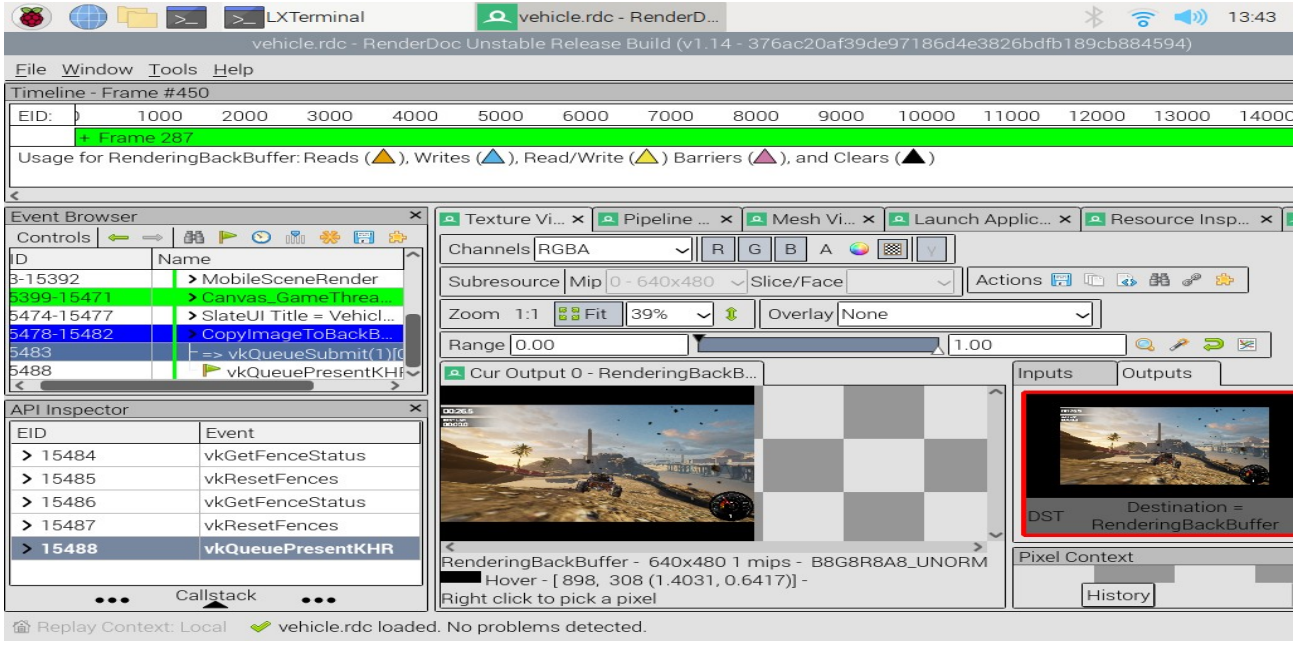
# 2021 status

- RenderDoc

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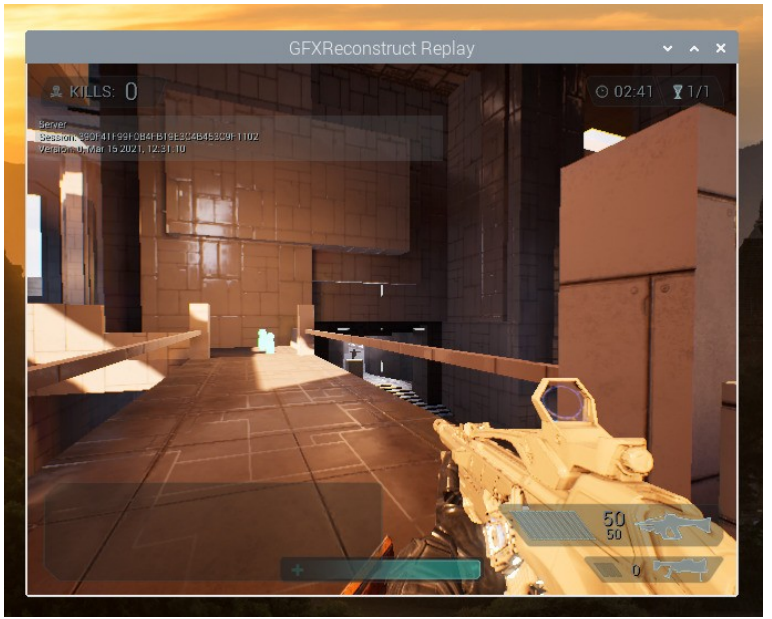
# 2021 status

- GFXReconstruct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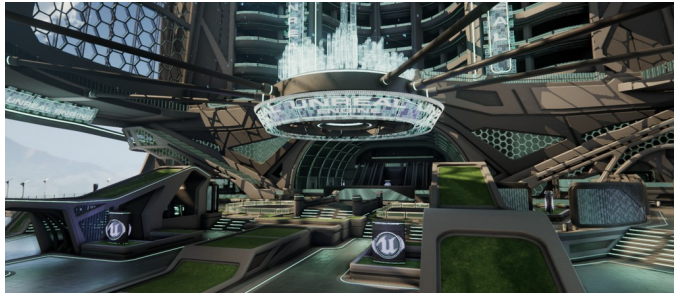
# 2021 status

- Various UE4 samples running successfully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# Performance

# Performance

- Driven by native Unreal Engine 4 samples
  - Generally GPU limited
  - Very expensive shading
- Focus on backend shader code optimizations
  - OpenGL/ES driver also benefited

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# Performance

- Process:
  - Capture generated shader code
  - Identify non optimal code traces
  - Figure out how that code is generated
  - Design & Implement optimizations
  - Verify results:
    - shader-db + GFXReconstruct + manual testing

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# Performance

- Better pipelining of TMU operations
- Non-TMU access for uniform UBO reads
- QPU code scheduling improvements
- Better instruction-level parallelism
- Better pipelining of varying setup instructions
- And many more...

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# Performance

Shader-db improvement (in %)

| Stat | Improvement |
| --- | --- |
| Threads | +1.06% |
| Instructions | -9.00% |
| Uniforms | -6.86% |
| Spills / Fills | -4.82% / -8.33% |

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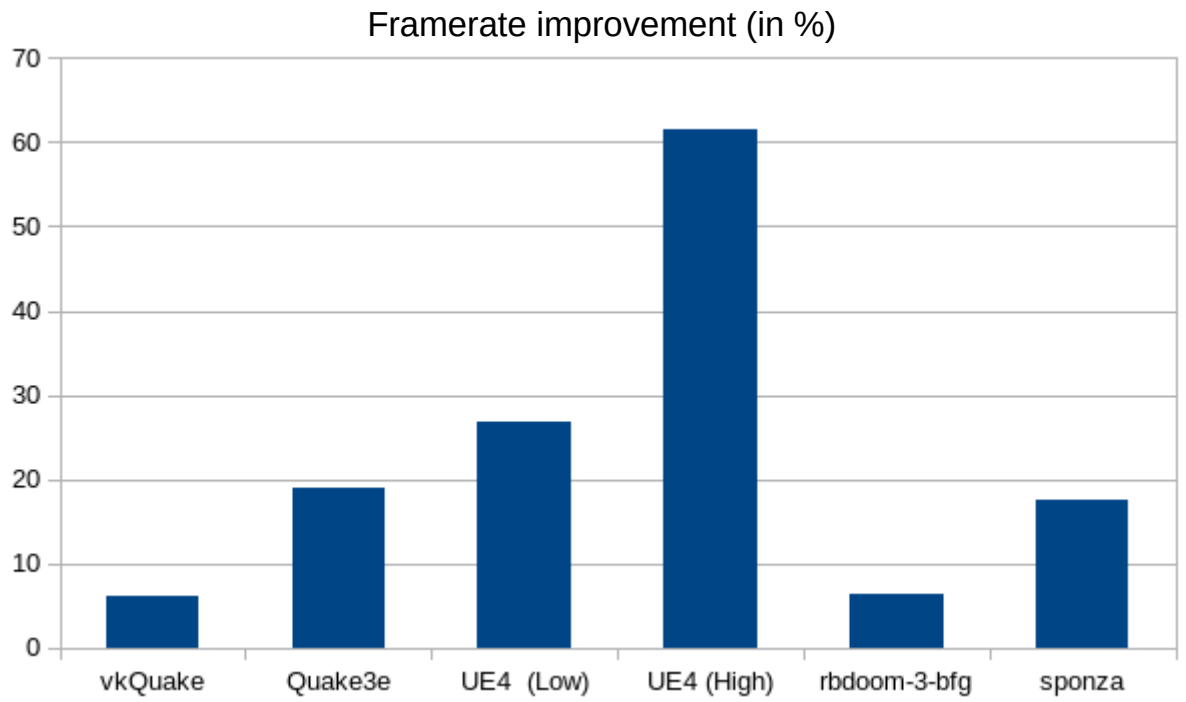
# Performance

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# Performance

- Many optimizations increase register pressure
- Recompile with opts disabled to avoid spills
- UE4 samples compile at run time → stutter
- Implemented a disk cache to mitigate this
  - Vulkan only for now

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# Performance

- NIR scheduling useful but very limited
  - Might want to consider a VIR scheduler
- Better VIR doesn’t always lead to better QPU
  - Room for improvement in RA and QPU scheduling
- Compile strategies not always optimal

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# Future Plans

# Future Plans

- Vulkan 1.1 conformance
- Continue adding extensions and features
  - Maybe start experimenting with fp16
- Resume performance work
- Improve kernel interface (multisync)
- Maybe start work on Vulkan 1.2

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# Contact

- IRC: #videocore@OFTC
- Mailing list: mesa-devel@freedesktop.org
- Gitlab: https://gitlab.freedesktop.org/mesa/mesa
- Blogs:

  https://blogs.igalia.com/itoral

  https://blogs.igalia.com/apinheiro

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# Q&A

We are hiring: www.igalia.com/jobs