



**Khronos Group
Request for Proposals
Vulkan Portability CTS
June 2022**

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1. Background

The Vulkan Portability Technical Subgroup was established in January 2018 to create an open, royalty-free API standard based on the existing Vulkan API specification to expand the deployment of Vulkan onto platforms that do not support native Vulkan implementations. Typically, this functionality is provided through a Vulkan implementation that is layered on top of another graphics API that is natively supported on the platform.

To address potential differences between the Vulkan feature set and features that are available through the native graphics APIs available on those platforms, the Vulkan Portability Technical Subgroup publishes a Vulkan extension specification, `VK_KHR_portability_subset`, that provides an API through which an application can query for Vulkan features that are not supported by the layered Vulkan implementation on that platform. The application can then adapt its behavior, based on the Vulkan features available on the platform.

Vulkan *Conformance Test Suite (CTS)* testing on an implementation that supports the `VK_KHR_portability_subset` extension also takes into consideration the feature set advertised by the layered implementation, and for any features that are not supported, reports Not Supported for any tests that make use of that feature, instead of reporting those test as Fail. With this behavior in place, a layered implementation that reports, via the extension, the Vulkan features that it does not support, can reach zero CTS failures, and be declared as conformant with Vulkan Portability.

MoltenVK, which provides Vulkan functionality layered on top of the Metal graphics API on Apple devices, is managed as a Khronos open-source project, and is a significant component of the Vulkan ecosystem.

At this writing, when tested under Vulkan 1.0 and the `VK_KHR_portability_subset` extension, MoltenVK fails 417 CTS tests. Effort is underway on the MoltenVK team to reduce the number of CTS failures to zero. However, to accelerate this effort, Khronos has approved a budget expense to hire additional MoltenVK development resources to apply to this effort.

2. Methodology

Khronos has a fixed budget for this project, with payment based on Time and Materials, to be invoiced and paid monthly.

This RFP is being circulated publicly, and is open to all respondents.

All code development shall take in place via approved contributions to the Khronos MoltenVK^[1], SPIRV-Cross^[2], or Vulkan CTS^[3] GitHub repositories, or others as deemed appropriate to the project goals.

3. Scope

The primary goal of this project is to reduce the number of CTS failures encountered when running MoltenVK under Vulkan 1.0 with no extensions.

The secondary goal of this project is to reduce the number of CTS failures encountered when running MoltenVK under its current full Vulkan feature set (currently Vulkan 1.1 with all supported extensions).

Tasks towards these goals will be assigned by the Vulkan Portability Technical Subgroup (TSG), under the supervision of the Vulkan Working Group (WG). The TSG may further delegate day-to-day task administration to select administrators and contributors of the MoltenVK repository.

To focus overall resources and talents efficiently, at the discretion of the Vulkan Portability TSG, the selected bidder may be assigned tasks, on the same code bases, outside the primary and secondary goals, if it frees up other resources to work on the primary and secondary goals.

4. Deliverables

The following deliverables are in priority order.

4.1. Reduce CTS failures for Vulkan 1.0

Reduce the number of CTS failures encountered when running MoltenVK under Vulkan 1.0 with no extensions. Appendix A below outlines the list of CTS failures that have been identified as addressable through this deliverable, via fixes to either MoltenVK or SPIRV-Cross.

4.2. Reduce CTS failures for full Vulkan feature set

Reduce the number of CTS failures encountered when running MoltenVK under its current full Vulkan feature set (currently Vulkan 1.1 with all supported extensions).

There are no fixed Acceptance Criteria, other than ongoing monitoring of progress on the primary and secondary deliverables. As a Time and Materials project, Khronos reserves the right to cancel this project, or terminate the services of the selected bidder, at any time during this project.

5. Schedule and Budget

Khronos has a budget of \$80,000 USD for this project and expects work to be completed over a period of several months from project initiation, with payment based on Time and Materials, to be invoiced and paid monthly.

6. Selection Process

Khronos shall designate a Khronos RFP Manager and will use an RFP email list (vulkan_rfp@lists.khronos.org) that can be used to contact the RFP Manager and all other Vulkan Working Group members involved in the bid selection process. No member making a bid shall be on the RFP list. Any company considering making a bid in response to the RFP should notify the RFP list as soon as possible. Any potential bidder may request additional information and submit questions directly to the RFP manager or on the RFP email list. Any additional Khronos information and RFP clarifications will be distributed equally to all potential bidders.

All bidders should provide the following information in the format of their choice:

- Availability to perform work, assuming work start in July 2022.
- Price for Time and Materials work, based on a per-hour billing rate.
- Confirmation that if your bid is accepted, you are willing to work under the terms of the Khronos Contractor Agreement^[4].
- Any issues or risk factors that they wish to highlight.
- Supporting materials, including background materials about their company, highlighting experience and expertise relevant to this project.

RFP responses are requested by **5PM PT on Friday June 24th, 2022** and should be sent to the RFP list. Bidders may update their bid as they wish before the submission deadline. In exceptional circumstances a requested submission deadline extension may be issued to all bidders at Khronos' discretion.

Khronos will evaluate all bids and select the winning bid based on relevant experience and expertise, availability to the project, and cost.

Khronos expects to announce the selected bid one week after the submission deadline and will immediately notify all bidders and enter into contract negotiations with the selected bidder to finalize deliverables and payment schedule. Khronos will immediately notify all other bidders once contract negotiations are complete. In the case contractual agreement cannot be reached, Khronos may select an alternative bidder and re-enter negotiations. Work can start immediately when the contract is negotiated and executed by both parties.

7. Contractors Agreement

The selected contractor will be required to execute the Khronos Contractors Agreement with Milestones and Costs entered into Exhibit B and Contractor Disclosures entered into Exhibit C.

No work shall begin, and Khronos shall be liable for no costs or expenses, until the selected contractor is in receipt of a mutually executed Contractor's Agreement.

It is important that contractors understand that, under the terms of the Contractors Agreement, Khronos will assess progress on a regular basis and reserves the right to terminate or renegotiate the contract in the event of insufficient progress or other issues.

8. References

[1] MoltenVK repository

<https://github.com/KhronosGroup/MoltenVK>

[2] SPIRV-Cross repository

<https://github.com/KhronosGroup/SPIRV-Cross>

[3] Vulkan CTS repository

<https://github.com/KhronosGroup/VK-GL-CTS>

[4] Khronos Contractors Agreement template

<https://members.khronos.org/document/dl/23303>

9. Appendix A – CTS Failures for Vulkan 1.0

The following table outlines the list of CTS failures that have been identified as addressable through the activities covered by the primary goal of this project.

depthClampDeltaOneBiasClampNegative	1	New	Likely SPIRV-Cross fix Metal non-conformance	https://github.com/KhronosGroup/Vulkan-Portability/issues/46
shaderDuplicateSpecId	3	New	Likely SPIRV-Cross fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/48
shaderFragmentDepth32FloatMultisample	3	New	Likely SPIRV-Cross fix Metal non-conformance	https://github.com/KhronosGroup/Vulkan-Portability/issues/44
shaderGraphicsFuzzConformance	3	New	Likely SPIRV-Cross fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/58
shaderIntCubeSampler	8	New	Likely SPIRV-Cross fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/43
shaderNoPositionC0E1	8	New	Likely SPIRV-Cross fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/39
shaderSharedCompositeVariables	53	New	Likely SPIRV-Cross fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/56
shaderSpecConstantOpCompositeInsert	5	New	Likely SPIRV-Cross fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/40
shaderSPIRVAssemblyConformance	6	New	Likely SPIRV-Cross fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/41
shaderTessellationInputOutputNesting	66	New	Likely SPIRV-Cross fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/51
depthClampMultipleViewport	2	New	Likely MoltenVK fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/47
shaderAtomicOperationLocal	2	New	Likely MoltenVK fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/49
shaderEarlyFragmentTestDiscardNoTestsStencil	1	New	Likely MoltenVK fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/52
shaderEarlyFragmentTestMultisampleDepth	2	New	Likely MoltenVK fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/53
shaderFragmentSamplerLod1DArrayShadow	2	New	Likely MoltenVK fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/42
shaderTessellationInputOutputBarrier	1	New	Likely MoltenVK fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/50
subpassDependencyLateFragmentTests	9	New	Likely MoltenVK fix	https://github.com/KhronosGroup/Vulkan-Portability/issues/45
	175	19	MoltenVK	
		156	SPIR-V Cross	