Vulkanised 2024

The 6th Vulkan Developer Conference
Sunnyvale, California | February 5-7, 2024

Better Vulkan Application Deployment thank to Vulkan Profiles

A.k.a. "Using the Vulkan Profiles Tools to develop and deploy a Vulkan application"

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Presentation:

https://bit.ly/3SkZZIe

Based on The Vulkan Profiles Tools whitepaper

https://bit.ly/4bmx6D6

Agenda

- A Vulkan Profiles introduction
- Creating and Using a Vulkan developer-defined Engine Profile
    - Writing the Engine JSON profile
    - Validating the JSON profile
    - Finding the required Vulkan API version for a profile
    - Generating the Vulkan Profiles API library using the profile
    - Using the Vulkan Profiles API library to check the support of profiles
    - Using the Vulkan Profiles API library to create instances
    - Generating human readable documentation of the profiles
- Creating and Using a Vulkan developer-defined Platform Profile
    - Selecting supported devices
    - Generating the Vulkan platform JSON profile
    - Setup the Profiles layer on the Vulkan developer system
    - Setup the Profiles layer on the C.I. platforms
    - Setup the Profiles layer programmatically
    - Use `Vulkaninfo` to generate a *Device Vulkan profile*

A Vulkan Profiles introduction

Why they matters to develop and deploy a Vulkan application?

What are Vulkan Profiles?

- Released with Vulkan 1.3
  - But it's not really a part of the Vulkan specification, they are essentially developer tools.
- A collection of Vulkan Capabilities
  - Extensions
  - Features
  - Properties
  - Queue properties
  - Formats
- A formalized dialogue method between the applications and the drivers, between components of the Vulkan ecosystem.

Vulkan Profiles use cases:

- ***Roadmap profiles***: to express guidance on the future direction of Vulkan devices. Eg: Khronos Roadmap 2024.
- ***Platform profiles***: to express the Vulkan support actually available on a platform. Eg: Android Baseline 2021.
- ***Device profiles***: to express the Vulkan support of a single Vulkan driver for a Vulkan device. Eg: GPUinfo.org reports
- ***Architecture profiles***: to express the Vulkan support of a class of GPUs. Eg: D3D12 Feature Level 12.1
- ***Engine profiles***: to express some rendering code paths requirements of an engine. Eg: VP_UE_Vulkan_SM6_RT in Unreal Engine.
- Etc.

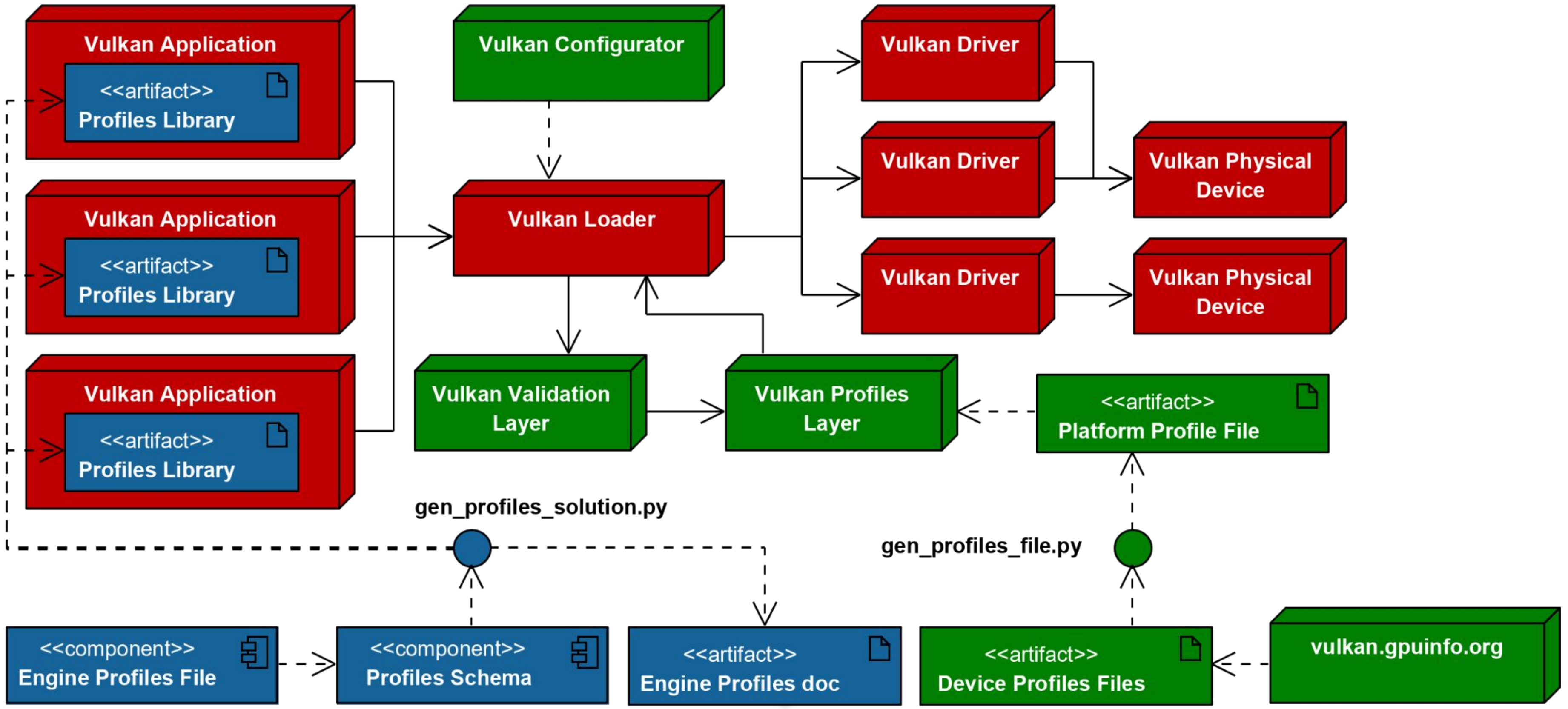
Vulkan Profiles by the Vulkan community

- DXVK: D3D9 - D3D11 to Vulkan
  - To document the Vulkan driver requirements to run D3D9 - D3D11 applications
  - Eg: `VP_DXVK_d3d9_baseline`, `VP_DXVK_d3d11_level_12_0_optimal`
- vkd3d-proton: D3D12 to Vulkan
  - To document the Vulkan driver requirements to run D3D12 applications
  - Eg: `VP_D3D12_FL_11_0_baseline`, `VP_D3D12_FL_12_2_optimal`, `VP_D3D12_maximum_radv`
- Zink: OpenGL 2.1 - 4.6 to Vulkan
  - To document the Vulkan driver requirements to run OpenGL applications
  - Eg: `VP_ZINK_gl21_baseline`, `VP_ZINK_gl46_optimal`
- Unreal Engine profiles:
  - To check the Vulkan support of the user system and select the available rendering code paths.
  - Eg: `VP_UE_Vulkan_SM5_Android_RT`, `VP_UE_Vulkan_SM6_RT`, `VP_UE_Vulkan_SM5`

List of the Vulkan Profiles Tools:

- Vulkan Profiles JSON schema
  - One JSON schema per Vulkan Header revision to check the correctness of a Vulkan Profiles JSON file
- Vulkan Profiles file generation
  - `Vulkaninfo` and GPUinfo.org export *Device Profile JSON files*
  - `gen_profiles_file.py` python script for multiple profiles intersection or union of capabilities
    - `VP_LUNARG_desktop_baseline_2022/2023/2024` provided as examples
- Vulkan Profiles layer
  - A layer to emulate/clamp profile capabilities on Vulkan developer system
- Vulkan Profiles API library
  - Convert JSON files into C++ code
  - A library for Vulkan applications code to check profiles support, to create `VkDevice` with features enabled
  - A KhronosGroup/Vulkan-Samples sample is available on github for demonstrating the library usage
- Vulkan Profiles comparison table
  - Markdown documentation, to easily read, search, compare capabilities across profiles

Vulkan Profiles Tools: How it all comes together?



Creating and Using a Vulkan developer-defined Engine profile

Writing the Engine JSON profile

```
"$schema": "https://schema.khronos.org/vulkan/profiles-0.8.2-276.json#",
"capabilities": {
    "my_block_name": {
        "extensions":{...}, "features":{...},
        "properties":{...}, "formats":{...},
    }
},
"profiles": {
    "VP_LUNARG_example_2024": {
        "version": 1, "api-version": "1.3.204",
        "label": "Vulkan Example 2024 profile",
        "description": "Description of Example 2024 profile",
        "profiles": [ "VP_LUNARG_minimum_requirements_1_3" ],
        "capabilities": [ "my_block_name" ]
    }
}
```

Writing the Engine JSON profile

```
"capabilities": {
    "my_block_name": {
        "features": {
            "VkPhysicalDeviceFeatures": {
                "multiDrawIndirect": true
            }
        },
        "properties": {
            "VkPhysicalDeviceProperties": {
                "limits": {
                    "maxColorAttachments": 8,
                    "maxBoundDescriptorSets": 7
                }
            }
        },
        "formats": {...}
    }
```

Writing the Engine JSON profile

```
"capabilities": {
    "my_block_name": {
        "formats": {
            "VK_FORMAT_R8G8B8A8_UNORM": {
                "VkFormatProperties": {
                    "linearTilingFeatures": [ "VK_FORMAT_FEATURE_COLOR_ATTACHMENT_BIT",
"VK_FORMAT_FEATURE_COLOR_ATTACHMENT_BLEND_BIT", "VK_FORMAT_FEATURE_BLIT_DST_BIT",
"VK_FORMAT_FEATURE_TRANSFER_SRC_BIT", "VK_FORMAT_FEATURE_TRANSFER_DST_BIT" ],
                    "optimalTilingFeatures": [ "VK_FORMAT_FEATURE_SAMPLED_IMAGE_BIT",
"VK_FORMAT_FEATURE_STORAGE_IMAGE_BIT", "VK_FORMAT_FEATURE_COLOR_ATTACHMENT_BIT",
"VK_FORMAT_FEATURE_COLOR_ATTACHMENT_BLEND_BIT", "VK_FORMAT_FEATURE_BLIT_SRC_BIT",
"VK_FORMAT_FEATURE_BLIT_DST_BIT", "VK_FORMAT_FEATURE_SAMPLED_IMAGE_FILTER_LINEAR_BIT",
"VK_FORMAT_FEATURE_TRANSFER_SRC_BIT", "VK_FORMAT_FEATURE_TRANSFER_DST_BIT" ],
                    "bufferFeatures": []
                }
            }
        }
    }
}
```

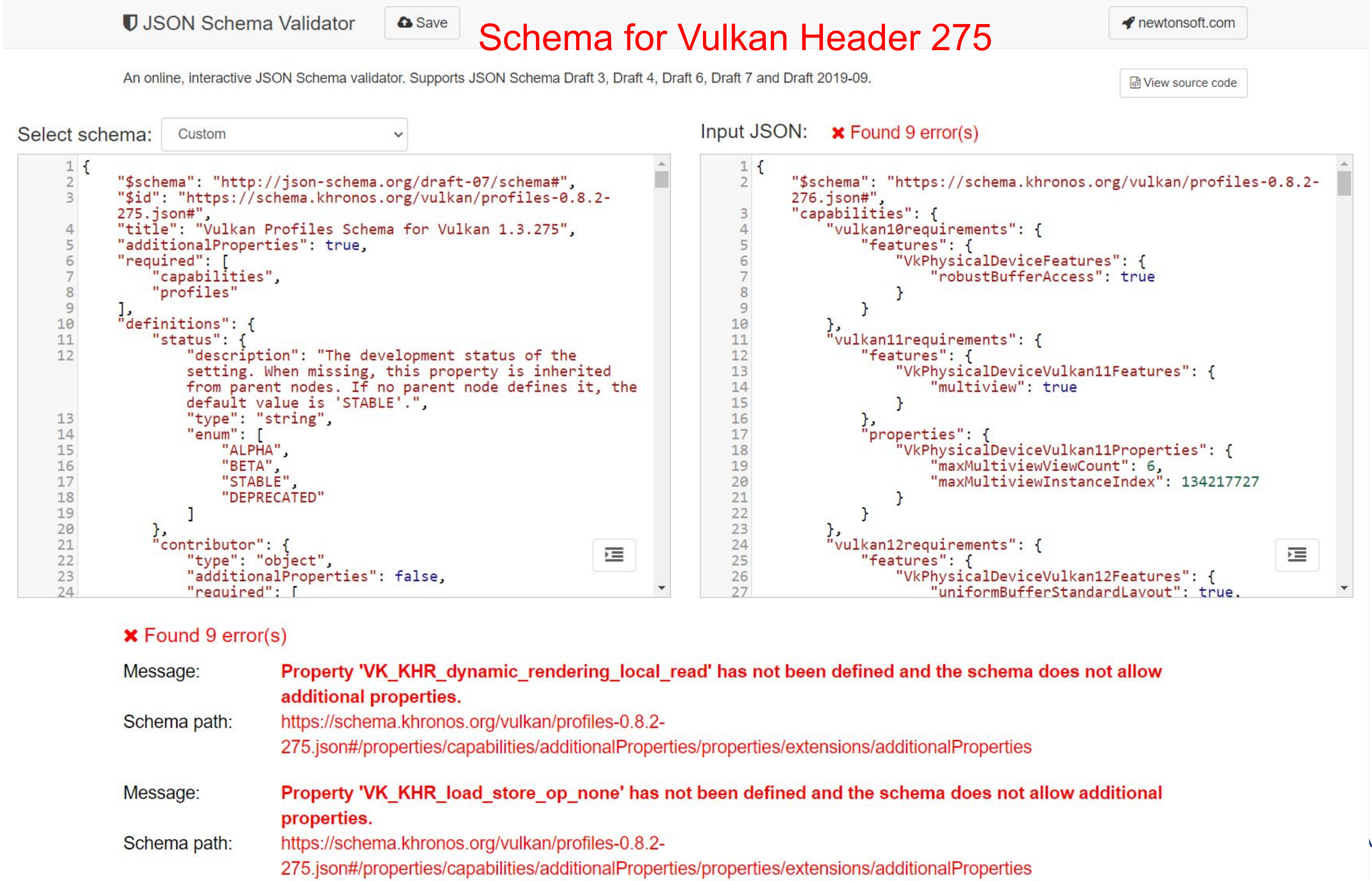
Validating the JSON profile

- To validate Vulkan Profiles file against the schema
  - It can be done online with http://www.jsonschemavalidator.net/
  - It can be done in C++ with libraries such as Valijson
  - It can be done in python with module like `jsonschema`
- For each Vulkan Header version, we generate a Profiles JSON schema
  - Profiles JSON schemas are available since Vulkan Header 96
    - On Khronos Schema website
    - In Khronos Schema Git repository

Finding the required Vulkan API version for a profile

- Following an example with the Vulkan Roadmap Profiles file
  - Using http://www.jsonschemavalidator.net/

Schema for Vulkan Header 275



JSON Schema Validator | Save | newtonsoft.com

An online, interactive JSON Schema validator. Supports JSON Schema Draft 3, Draft 4, Draft 6, Draft 7 and Draft 2019-09.

View source code

Select schema: Custom

```
{
    "$schema": "http://json-schema.org/draft-07/schema#",
    "$id": "https://schema.khronos.org/vulkan/profiles-0.8.2-
    275.json#",
    "title": "Vulkan Profiles Schema for Vulkan 1.3.275",
    "additionalProperties": true,
    "required": [
        "capabilities",
        "profiles"
    ],
    "definitions": {
        "status": {
            "description": "The development status of the
            setting. When missing, this property is inherited
            from parent nodes. If no parent node defines it, the
            default value is 'STABLE'.",
            "type": "string",
            "enum": [
                "ALPHA",
                "BETA",
                "STABLE",
                "DEPRECATED"
            ]
        },
        "contributor": {
            "type": "object",
            "additionalProperties": false,
            "required": [
```

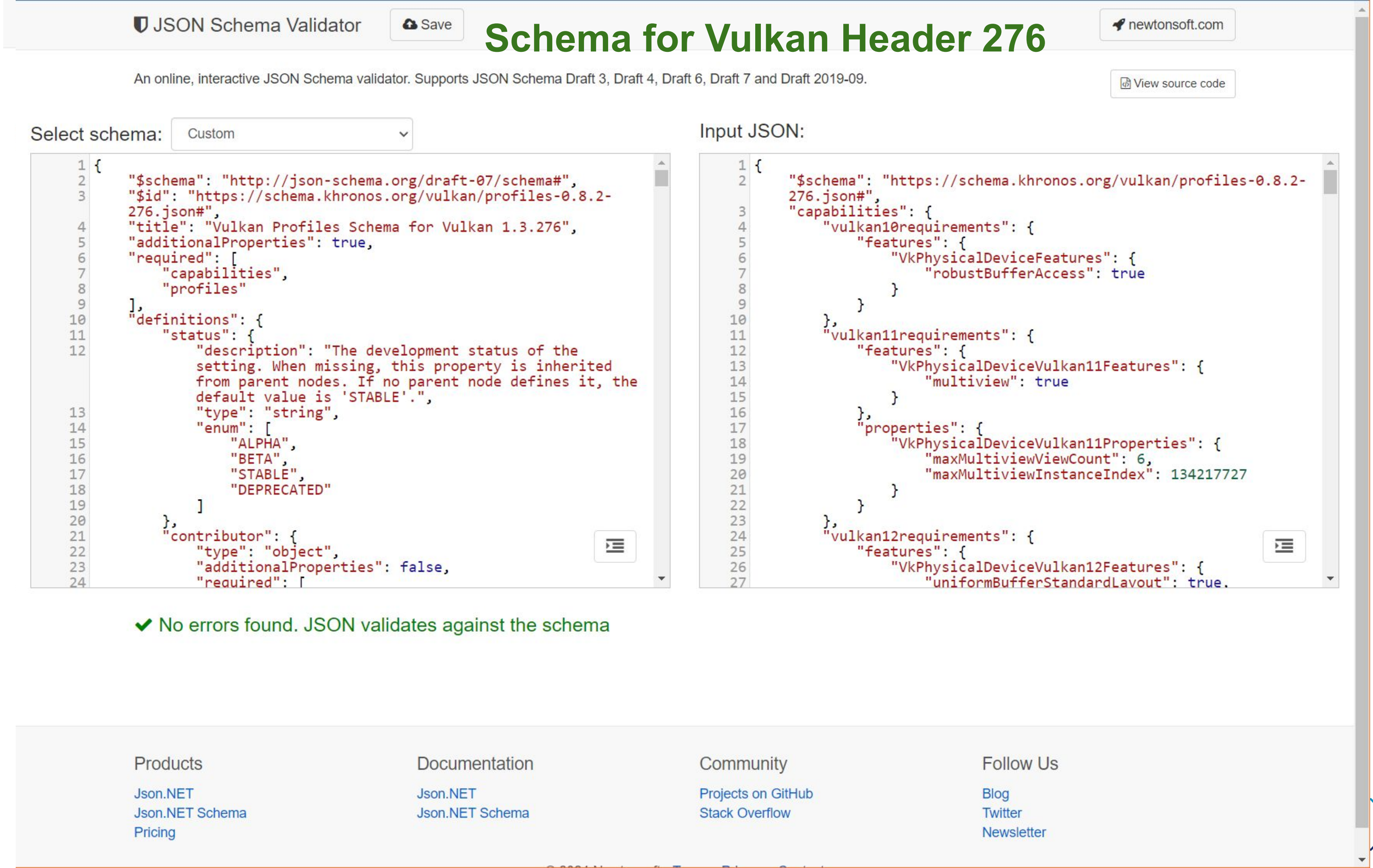
Input JSON: ✖ Found 9 error(s)

```
{
    "$schema": "https://schema.khronos.org/vulkan/profiles-0.8.2-
    276.json#",
    "capabilities": {
        "vulkan10requirements": {
            "features": {
                "VkPhysicalDeviceFeatures": {
                    "robustBufferAccess": true
                }
            }
        },
        "vulkan11requirements": {
            "features": {
                "VkPhysicalDeviceVulkan11Features": {
                    "multiview": true
                }
            },
            "properties": {
                "VkPhysicalDeviceVulkan11Properties": {
                    "maxMultiviewViewCount": 6,
                    "maxMultiviewInstanceIndex": 134217727
                }
            }
        },
        "vulkan12requirements": {
            "features": {
                "VkPhysicalDeviceVulkan12Features": {
                    "uniformBufferStandardLayout": true,
```

✖ Found 9 error(s)

Message:	**Property 'VK_KHR_dynamic_rendering_local_read' has not been defined and the schema does not allow additional properties.**
Schema path:	https://schema.khronos.org/vulkan/profiles-0.8.2-275.json#/properties/capabilities/additionalProperties/properties/extensions/additionalProperties
Message:	**Property 'VK_KHR_load_store_op_none' has not been defined and the schema does not allow additional properties.**
Schema path:	https://schema.khronos.org/vulkan/profiles-0.8.2-275.json#/properties/capabilities/additionalProperties/properties/extensions/additionalProperties

Schema for Vulkan Header 276



JSON Schema Validator

Save

newtonsoft.com

An online, interactive JSON Schema validator. Supports JSON Schema Draft 3, Draft 4, Draft 6, Draft 7 and Draft 2019-09.

View source code

Select schema: Custom

```
{
    "$schema": "http://json-schema.org/draft-07/schema#",
    "$id": "https://schema.khronos.org/vulkan/profiles-0.8.2-
    276.json#",
    "title": "Vulkan Profiles Schema for Vulkan 1.3.276",
    "additionalProperties": true,
    "required": [
        "capabilities",
        "profiles"
    ],
    "definitions": {
        "status": {
            "description": "The development status of the
            setting. When missing, this property is inherited
            from parent nodes. If no parent node defines it, the
            default value is 'STABLE'.",
            "type": "string",
            "enum": [
                "ALPHA",
                "BETA",
                "STABLE",
                "DEPRECATED"
            ]
        },
        "contributor": {
            "type": "object",
            "additionalProperties": false,
            "required": [
```

Input JSON:

```
{
    "$schema": "https://schema.khronos.org/vulkan/profiles-0.8.2-
    276.json#",
    "capabilities": {
        "vulkan10requirements": {
            "features": {
                "VkPhysicalDeviceFeatures": {
                    "robustBufferAccess": true
                }
            }
        },
        "vulkan11requirements": {
            "features": {
                "VkPhysicalDeviceVulkan11Features": {
                    "multiview": true
                }
            },
            "properties": {
                "VkPhysicalDeviceVulkan11Properties": {
                    "maxMultiviewViewCount": 6,
                    "maxMultiviewInstanceIndex": 134217727
                }
            }
        },
        "vulkan12requirements": {
            "features": {
                "VkPhysicalDeviceVulkan12Features": {
                    "uniformBufferStandardLayout": true,
```

✓ No errors found. JSON validates against the schema

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Generating the Profiles API library using the Engine profile

- The Vulkan SDK ships with the `gen_profiles_solution.py` script
  - To convert Vulkan Profiles from JSON to C++
- This script is used generate the *Vulkan Profiles API library* with any Profiles needed by the Vulkan application developer

Generating the Profiles API library using the engine profile

```
python gen_profiles_solution.py
  --registry vk.xml
  --input ./my_profiles/
  --output-library-inc ./my_library/
  --output-library-src ./my_library/
  --debug
```

Using the Profiles API library to check the support of profiles

```
VkBool32 supported = VK_FALSE;
VpProfileProperties profile{
  VP_LUNARG_EXAMPLE_2024_NAME, VP_LUNARG_EXAMPLE_2024_SPEC_VERSION};

VkResult result = vpGetInstanceProfileSupport(
    nullptr, &profile, &supported);
if (result != VK_SUCCESS) {
    // something went wrong
    ...
}
else if (supported != VK_TRUE) {
     // profile is not supported at the instance level
     ...
}
```

Using the Profiles API library to check the support of profiles

```
VkBool32 supported = VK_FALSE;
VpProfileProperties profile{
  VP_LUNARG_EXAMPLE_2024_NAME, VP_LUNARG_EXAMPLE_2024_SPEC_VERSION};

VkResult result = vpGetPhysicalDeviceProfileSupport(
    instance, physicalDevice, &profile, &supported);
if (result != VK_SUCCESS) {
    // something went wrong
    ...
}
else if (supported != VK_TRUE) {
    // profile is not supported at the device level
    ...
}
```

Using the Profiles API library to check the support of profiles

An iterative process to create Engine profiles:

- Hit an assert or validation layer error that check Vulkan requirements in the engine code
- Add these requirements to the Engine profiles file
- Regenerated the library
- The Vulkan application now check correctly the system capabilities on start

Checking Vulkan Profiles variants support

```
VkResult vpGetInstanceProfileVariantsSupport(
    const char*                     pLayerName,
    const VpProfileProperties*      pProfile,
    VkBool32*                       pSupported,
    uint32_t*                       pPropertyCount,
    VpBlockProperties*              pProperties);


VkResult vpGetPhysicalDeviceProfileVariantsSupport(
    VkInstance                      instance,
    VkPhysicalDevice                physicalDevice,
    const VpProfileProperties*      pProfile,
    VkBool32*                       pSupported,
    uint32_t*                       pPropertyCount,
    VpBlockProperties*              pProperties);
```

Using the Profiles API library to create instances

```
VpProfileProperties profile{
  VP_LUNARG_EXAMPLE_2024_NAME, VP_LUNARG_EXAMPLE_2024_SPEC_VERSION};

// Set API version to the minimum API version required by the profile
vkAppInfo.apiVersion = VP_LUNARG_EXAMPLE_2024_MIN_API_VERSION;
VkInstanceCreateInfo vkCreateInfo{ VK_STRUCTURE_TYPE_INSTANCE_CREATE_INFO };
vkCreateInfo.pApplicationInfo = &vkAppInfo;
// For additional Vulkan Extensions, add those to vkCreateInfo as usual.
...

VpInstanceCreateInfo vpCreateInfo{};
createInfo.pCreateInfo = &vkCreateInfo;
createInfo.enabledFullProfileCount = 1;
createInfo.pEnabledFullProfiles = &profile;

VkInstance instance = VK_NULL_HANDLE;
VkResult result = vpCreateInstance(&vpCreateInfo, nullptr, &instance);
```

Using the Profiles API library to create instances

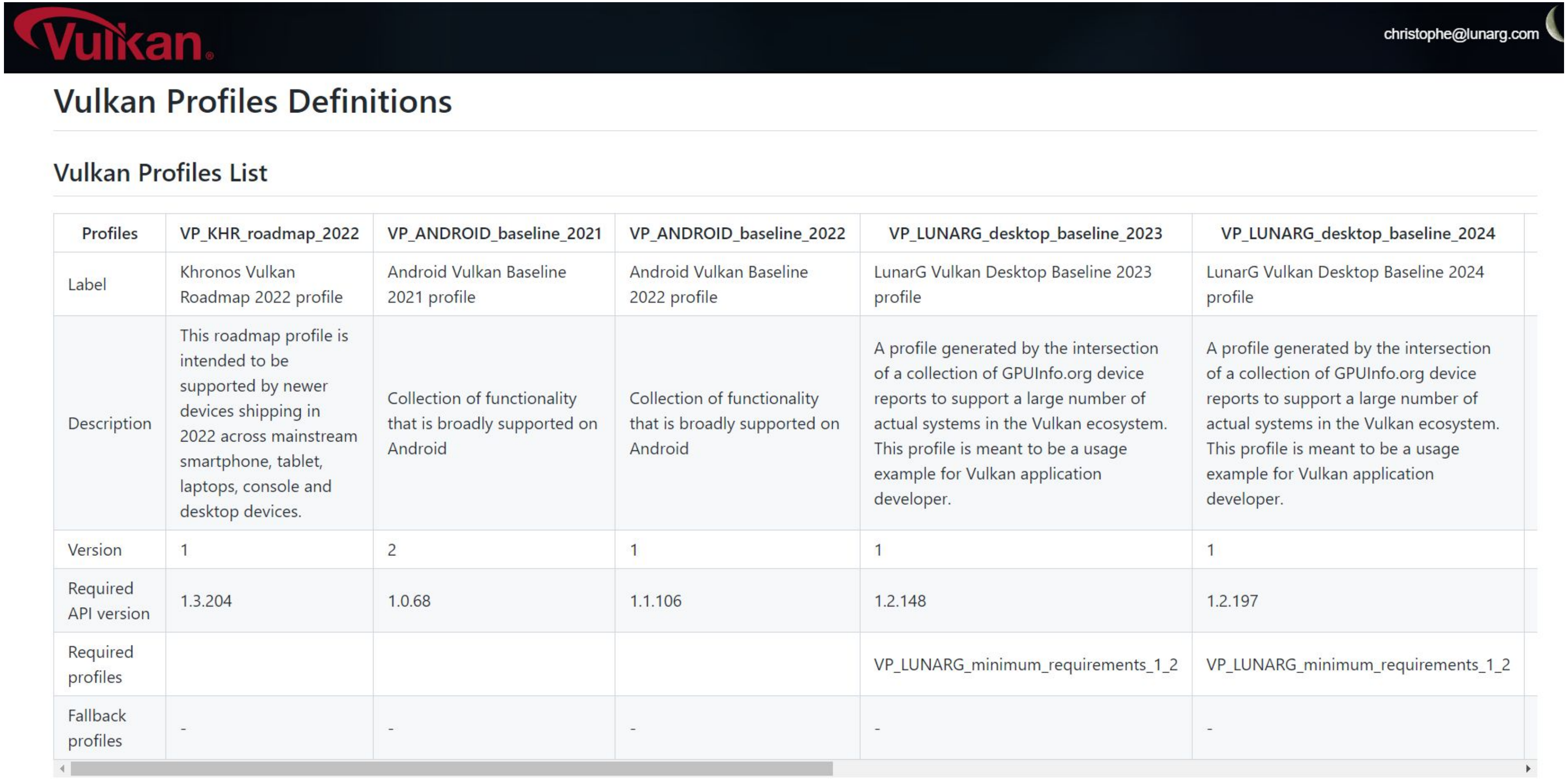
```
VpProfileProperties profile{
  VP_LUNARG_EXAMPLE_2024_NAME, VP_LUNARG_EXAMPLE_2024_SPEC_VERSION};

VkDeviceCreateInfo vkCreateInfo{ VK_STRUCTURE_TYPE_DEVICE_CREATE_INFO };
// For additional Vulkan Extensions and Features, add those to vkCreateInfo
// as usual.
...

VpDeviceCreateInfo vpCreateInfo{};
createInfo.pCreateInfo = &vkCreateInfo;
createInfo.pProfile = &profile;

VkDevice device = VK_NULL_HANDLE;
result = vpCreateDevice(physicalDevice, &vpCreateInfo, nullptr, &device);
```

Generating human readable documentation of the profiles



Vulkan

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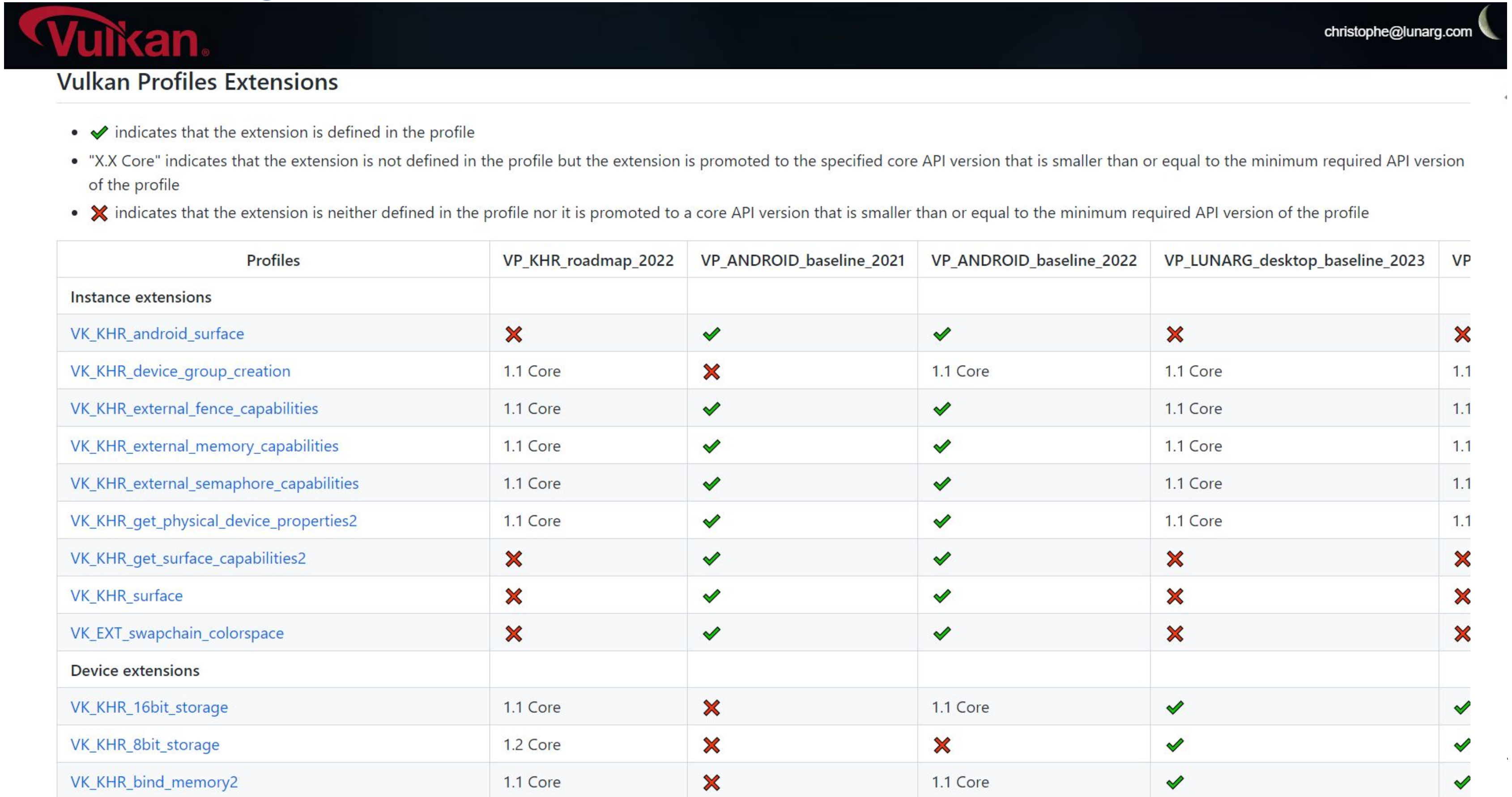
Vulkan Profiles Definitions

Vulkan Profiles List

Profiles	VP_KHR_roadmap_2022	VP_ANDROID_baseline_2021	VP_ANDROID_baseline_2022	VP_LUNARG_desktop_baseline_2023	VP_LUNARG_desktop_baseline_2024
Label	Khronos Vulkan Roadmap 2022 profile	Android Vulkan Baseline 2021 profile	Android Vulkan Baseline 2022 profile	LunarG Vulkan Desktop Baseline 2023 profile	LunarG Vulkan Desktop Baseline 2024 profile
Description	This roadmap profile is intended to be supported by newer devices shipping in 2022 across mainstream smartphone, tablet, laptops, console and desktop devices.	Collection of functionality that is broadly supported on Android	Collection of functionality that is broadly supported on Android	A profile generated by the intersection of a collection of GPUInfo.org device reports to support a large number of actual systems in the Vulkan ecosystem. This profile is meant to be a usage example for Vulkan application developer.	A profile generated by the intersection of a collection of GPUInfo.org device reports to support a large number of actual systems in the Vulkan ecosystem. This profile is meant to be a usage example for Vulkan application developer.
Version	1	2	1	1	1
Required API version	1.3.204	1.0.68	1.1.106	1.2.148	1.2.197
Required profiles				VP_LUNARG_minimum_requirements_1_2	VP_LUNARG_minimum_requirements_1_2
Fallback profiles	-	-	-	-	-

Generating human readable documentation of the profiles



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Vulkan Profiles Extensions

- ✓ indicates that the extension is defined in the profile
- "X.X Core" indicates that the extension is not defined in the profile but the extension is promoted to the specified core API version that is smaller than or equal to the minimum required API version of the profile
- ✗ indicates that the extension is neither defined in the profile nor it is promoted to a core API version that is smaller than or equal to the minimum required API version of the profile

Profiles	VP_KHR_roadmap_2022	VP_ANDROID_baseline_2021	VP_ANDROID_baseline_2022	VP_LUNARG_desktop_baseline_2023	VP
Instance extensions					
VK_KHR_android_surface	✗	✓	✓	✗	✗
VK_KHR_device_group_creation	1.1 Core	✗	1.1 Core	1.1 Core	1.1
VK_KHR_external_fence_capabilities	1.1 Core	✓	✓	1.1 Core	1.1
VK_KHR_external_memory_capabilities	1.1 Core	✓	✓	1.1 Core	1.1
VK_KHR_external_semaphore_capabilities	1.1 Core	✓	✓	1.1 Core	1.1
VK_KHR_get_physical_device_properties2	1.1 Core	✓	✓	1.1 Core	1.1
VK_KHR_get_surface_capabilities2	✗	✓	✓	✗	✗
VK_KHR_surface	✗	✓	✓	✗	✗
VK_EXT_swapchain_colorspace	✗	✓	✓	✗	✗
Device extensions					
VK_KHR_16bit_storage	1.1 Core	✗	1.1 Core	✓	✓
VK_KHR_8bit_storage	1.2 Core	✗	✗	✓	✓
VK_KHR_bind_memory2	1.1 Core	✗	1.1 Core	✓	✓

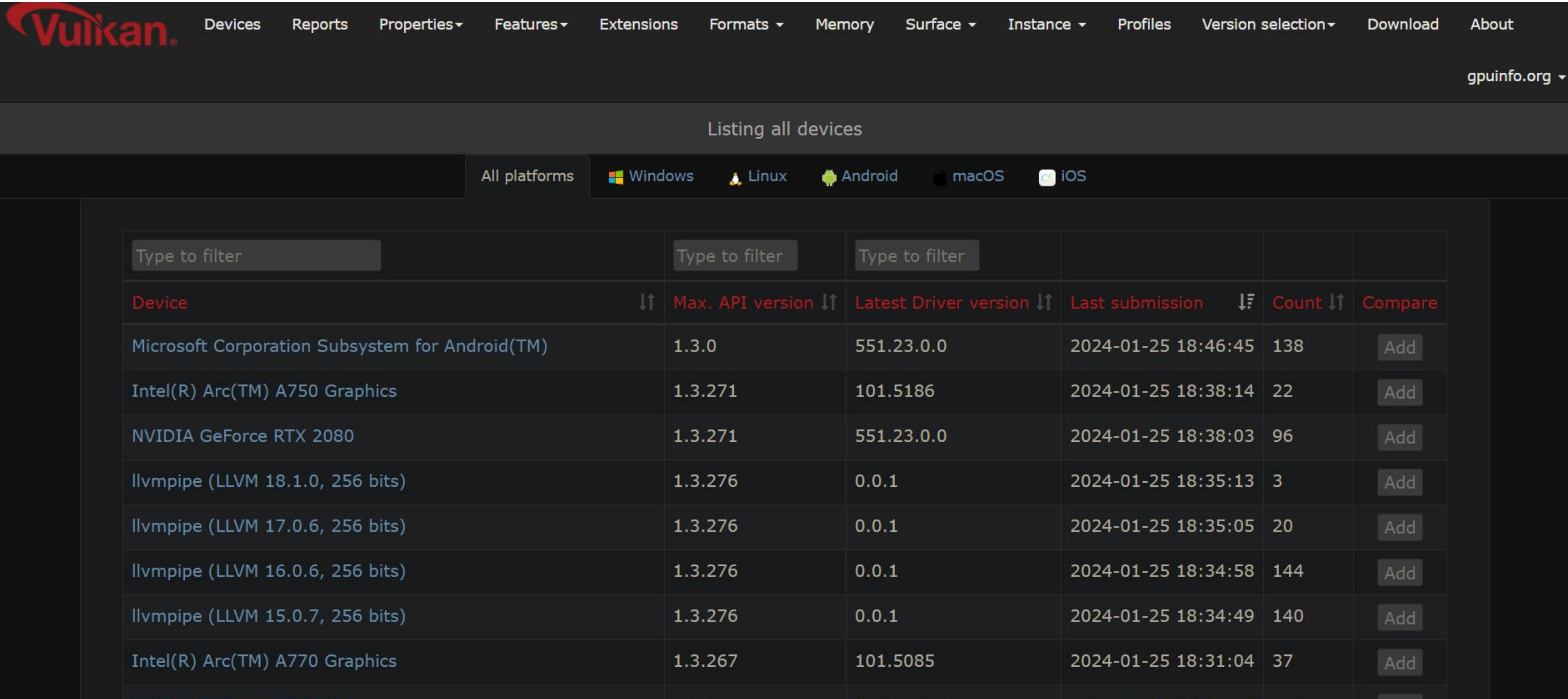
Generating human readable documentation of the profiles

This table can be generated for any set of profiles using the following command:

```
python gen_profiles_solution.py
  --registry vk.xml
  --input ./my_engine_profiles/
  --output-doc ./PROFILES.md
```

Creating and Using a Vulkan developer-defined Platform profile

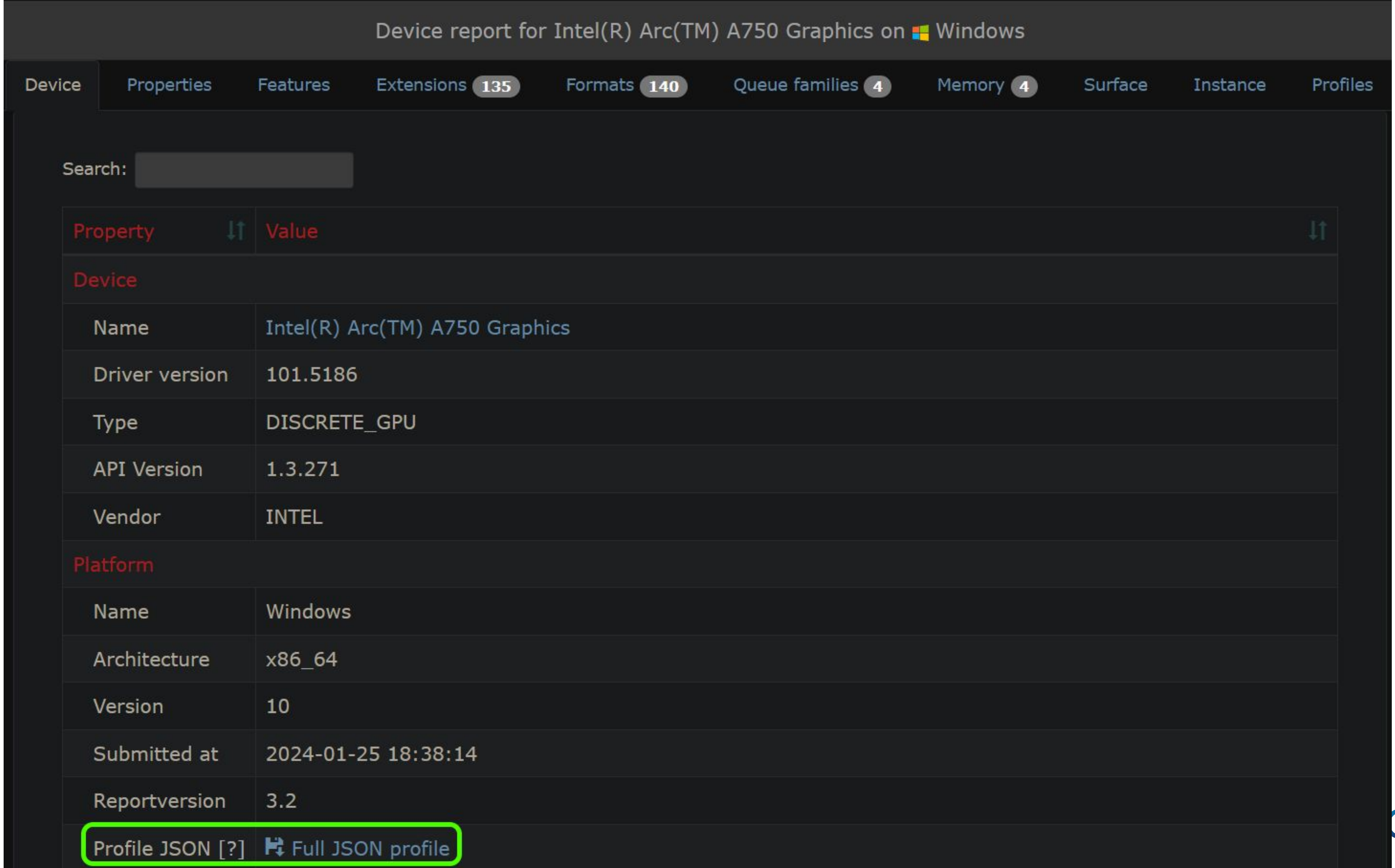
Selecting supported devices



Listing all devices

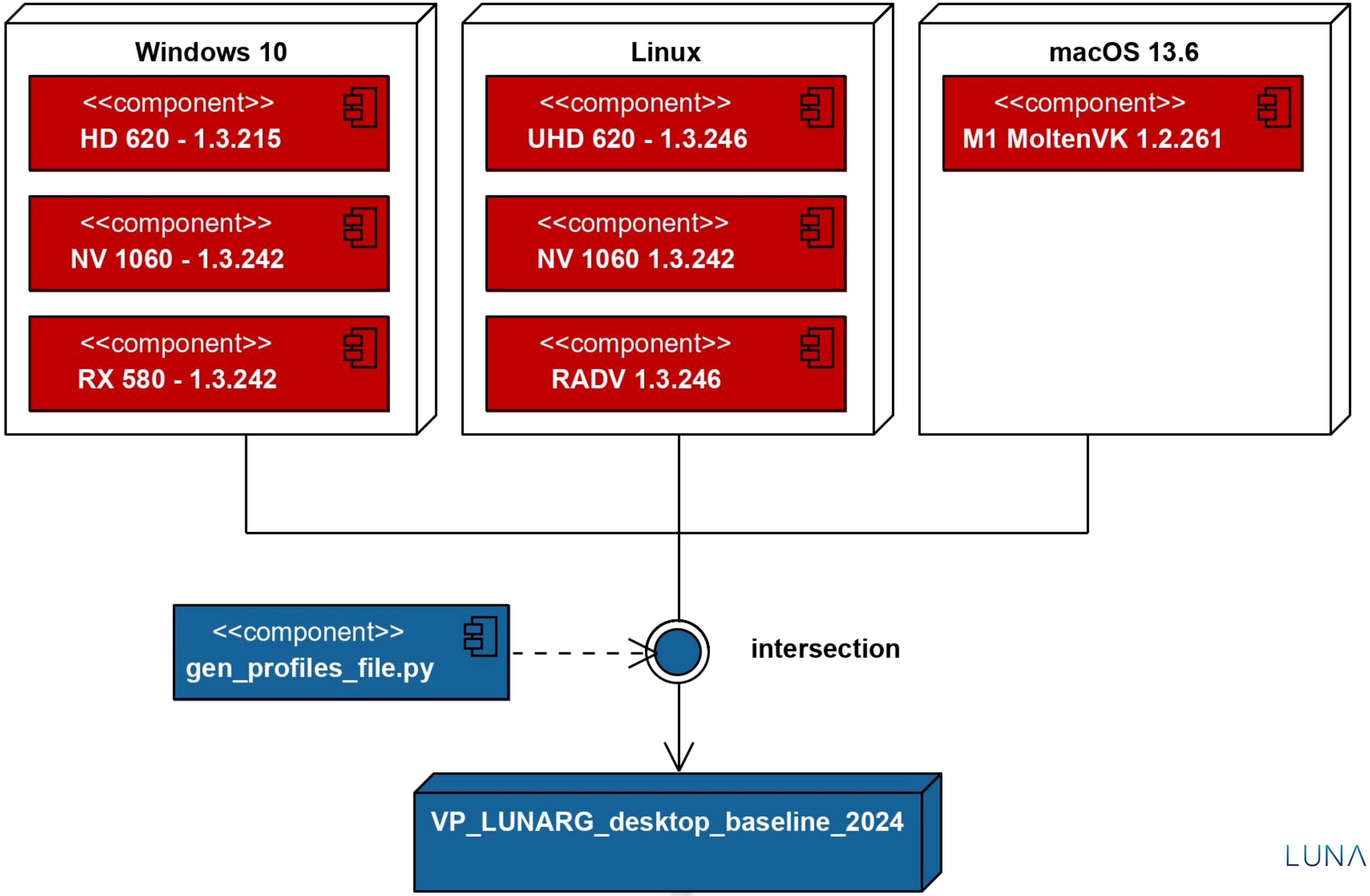
All platforms | Windows | Linux | Android | macOS | iOS

Device	Max. API version	Latest Driver version	Last submission	Count	Compare
Microsoft Corporation Subsystem for Android(TM)	1.3.0	551.23.0.0	2024-01-25 18:46:45	138	Add
Intel(R) Arc(TM) A750 Graphics	1.3.271	101.5186	2024-01-25 18:38:14	22	Add
NVIDIA GeForce RTX 2080	1.3.271	551.23.0.0	2024-01-25 18:38:03	96	Add
llvmpipe (LLVM 18.1.0, 256 bits)	1.3.276	0.0.1	2024-01-25 18:35:13	3	Add
llvmpipe (LLVM 17.0.6, 256 bits)	1.3.276	0.0.1	2024-01-25 18:35:05	20	Add
llvmpipe (LLVM 16.0.6, 256 bits)	1.3.276	0.0.1	2024-01-25 18:34:58	144	Add
llvmpipe (LLVM 15.0.7, 256 bits)	1.3.276	0.0.1	2024-01-25 18:34:49	140	Add
Intel(R) Arc(TM) A770 Graphics	1.3.267	101.5085	2024-01-25 18:31:04	37	Add



Device report for Intel(R) Arc(TM) A750 Graphics on Windows

Property	Value
Device	
Name	Intel(R) Arc(TM) A750 Graphics
Driver version	101.5186
Type	DISCRETE_GPU
API Version	1.3.271
Vendor	INTEL
Platform	
Name	Windows
Architecture	x86_64
Version	10
Submitted at	2024-01-25 18:38:14
Reportversion	3.2
Profile JSON [?]	Full JSON profile

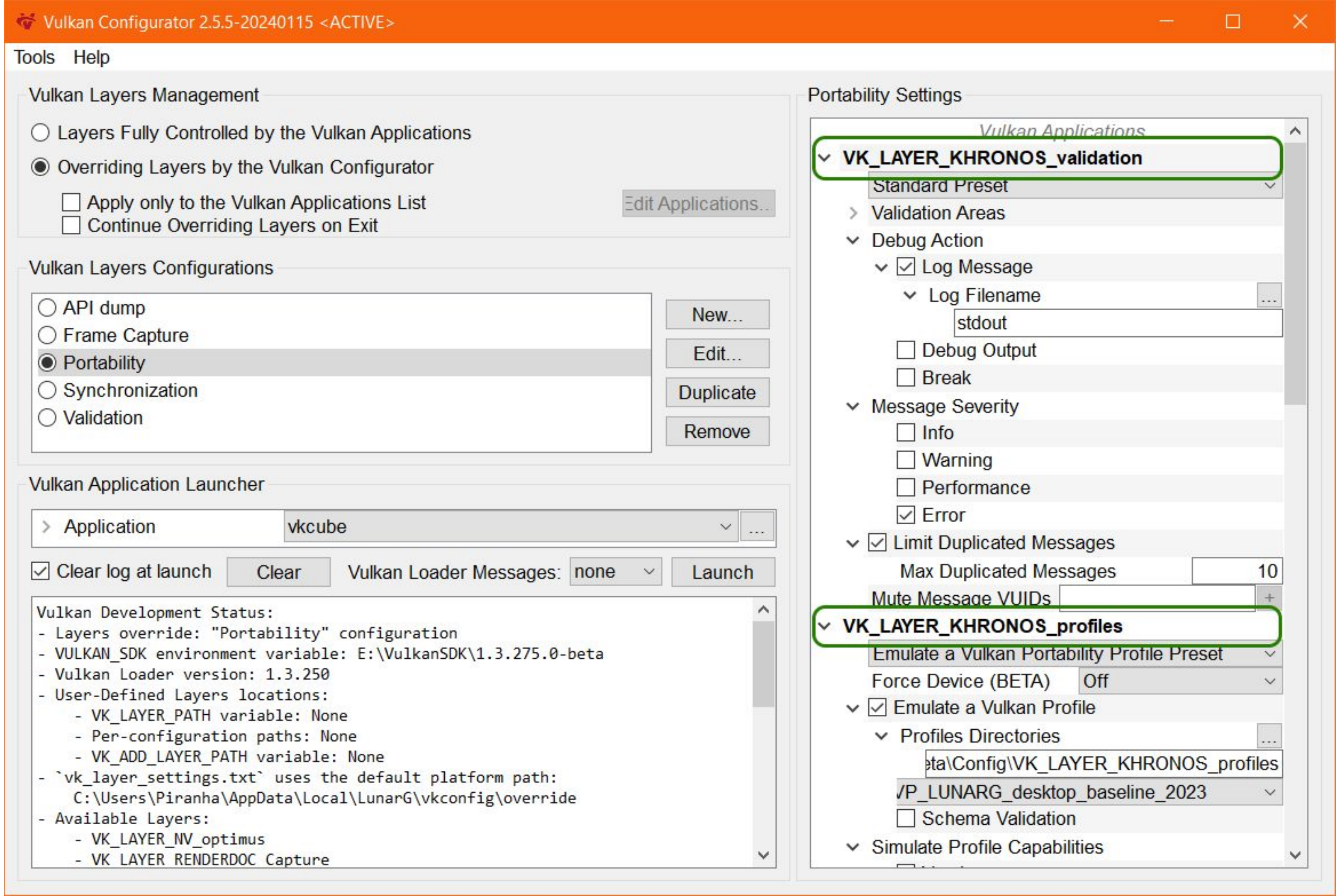

Windows 10
<<component>>
HD 620 - 1.3.215
<<component>>
NV 1060 - 1.3.242
<<component>>
RX 580 - 1.3.242
Linux
<<component>>
UHD 620 - 1.3.246
<<component>>
NV 1060 1.3.242
<<component>>
RADV 1.3.246
macOS 13.6
<<component>>
M1 MoltenVK 1.2.261
<<component>>
gen_profiles_file.py
intersection
VP_LUNARG_desktop_baseline_2024

Generating the Vulkan platform JSON profile

```
python gen_profiles_file.py
  --registry vk.xml
  --input ./VP_LUNARG_desktop_baseline_2024
  --output-path ./VP_LUNARG_desktop_baseline_2024.json
  --output-profile VP_LUNARG_desktop_baseline_2024
  --profile-label "LunarG Desktop Baseline 2024 profile"
  --profile-desc "LunarG Desktop Baseline 2024 description"
  --profile-date 2023-11-01
  --profile-api-version "1.2.197"
  --profile-required-profiles "VP_LUNARG_minimum_requirements_1_2"
  --strip-duplicate-structs
```

Configuring the layers on the developer system

- Based on *Configuring Vulkan Layers* whitepaper
    - Using the GUI application called *Vulkan Configurator*
    - Using environment variables
    - Using the Vulkan API: `vkCreateInstance()` and `VK_EXT_layer_settings`
- The layer settings are documented by each layer:
    - Profiles layer documentation
    - Validation layer documentation



Vulkan Configurator 2.5.5-20240115 <ACTIVE>

Tools Help

Vulkan Layers Management

- ( ) Layers Fully Controlled by the Vulkan Applications
- (●) Overriding Layers by the Vulkan Configurator
  - ☐ Apply only to the Vulkan Applications List — Edit Applications...
  - ☐ Continue Overriding Layers on Exit

Vulkan Layers Configurations

- ( ) API dump
- ( ) Frame Capture
- (●) Portability
- ( ) Synchronization
- ( ) Validation

New... Edit... Duplicate Remove

Vulkan Application Launcher

Application: vkcube

☑ Clear log at launch — Clear — Vulkan Loader Messages: none — Launch

```
Vulkan Development Status:
- Layers override: "Portability" configuration
- VULKAN_SDK environment variable: E:\VulkanSDK\1.3.275.0-beta
- Vulkan Loader version: 1.3.250
- User-Defined Layers locations:
    - VK_LAYER_PATH variable: None
    - Per-configuration paths: None
    - VK_ADD_LAYER_PATH variable: None
- `vk_layer_settings.txt` uses the default platform path:
    C:\Users\Piranha\AppData\Local\LunarG\vkconfig\override
- Available Layers:
    - VK_LAYER_NV_optimus
    - VK_LAYER_RENDERDOC_Capture
```

Portability Settings

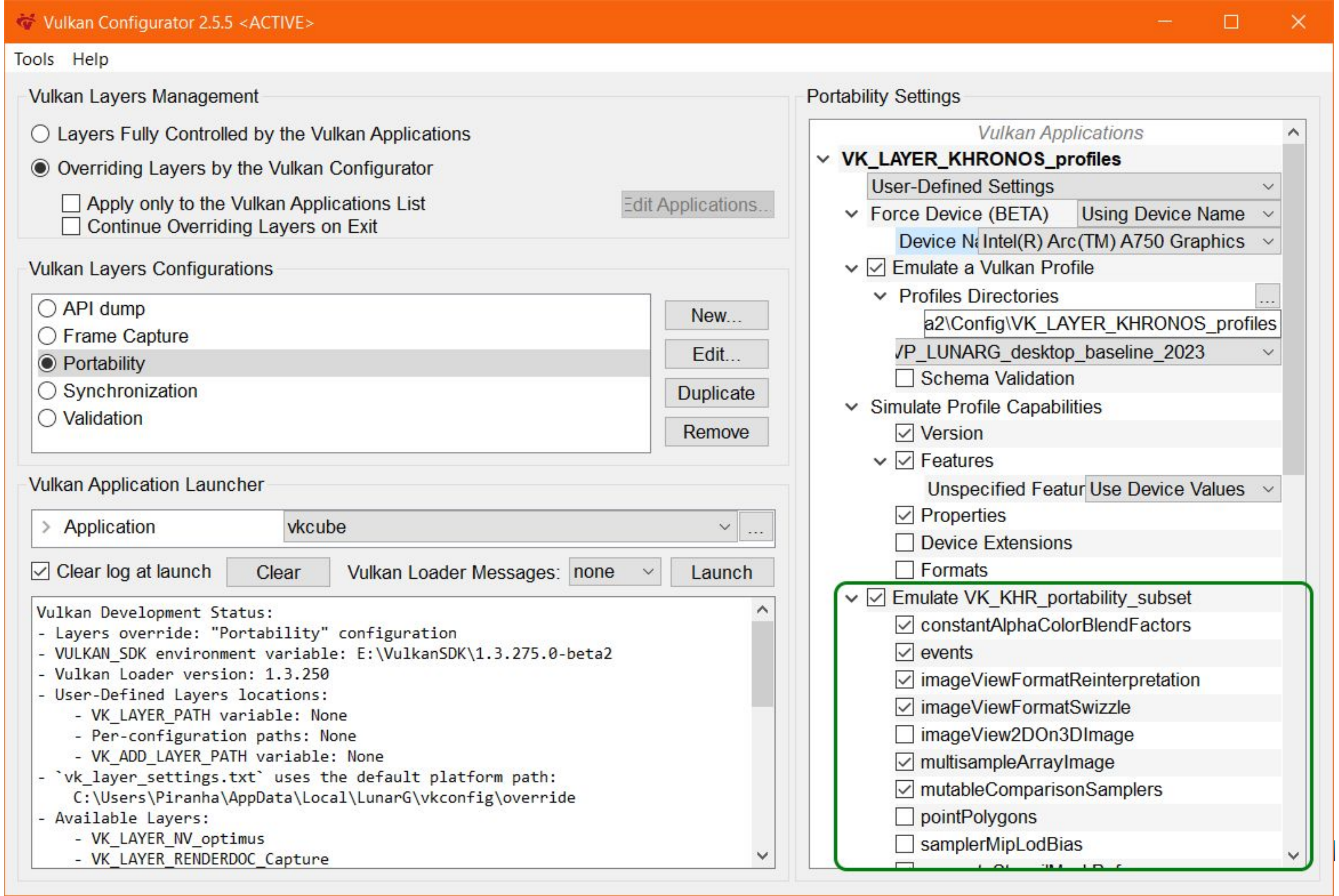
Vulkan Applications

VK_LAYER_KHRONOS_validation

- Standard Preset
- Validation Areas
- Debug Action
  - ☑ Log Message
    - Log Filename: stdout
  - ☐ Debug Output
  - ☐ Break
- Message Severity
  - ☐ Info
  - ☐ Warning
  - ☐ Performance
  - ☑ Error
- ☑ Limit Duplicated Messages
  - Max Duplicated Messages: 10
- Mute Message VUIDs

VK_LAYER_KHRONOS_profiles

- Emulate a Vulkan Portability Profile Preset
- Force Device (BETA): Off
- ☑ Emulate a Vulkan Profile
  - Profiles Directories: ta\Config\VK_LAYER_KHRONOS_profiles
  - /P_LUNARG_desktop_baseline_2023
  - ☐ Schema Validation
- Simulate Profile Capabilities



Vulkan Configurator 2.5.5 <ACTIVE>

Tools Help

Vulkan Layers Management

( ) Layers Fully Controlled by the Vulkan Applications
(●) Overriding Layers by the Vulkan Configurator
☐ Apply only to the Vulkan Applications List
☐ Continue Overriding Layers on Exit

Edit Applications...

Vulkan Layers Configurations

( ) API dump
( ) Frame Capture
(●) Portability
( ) Synchronization
( ) Validation

New... Edit... Duplicate Remove

Vulkan Application Launcher

Application: vkcube

☑ Clear log at launch — Clear — Vulkan Loader Messages: none — Launch

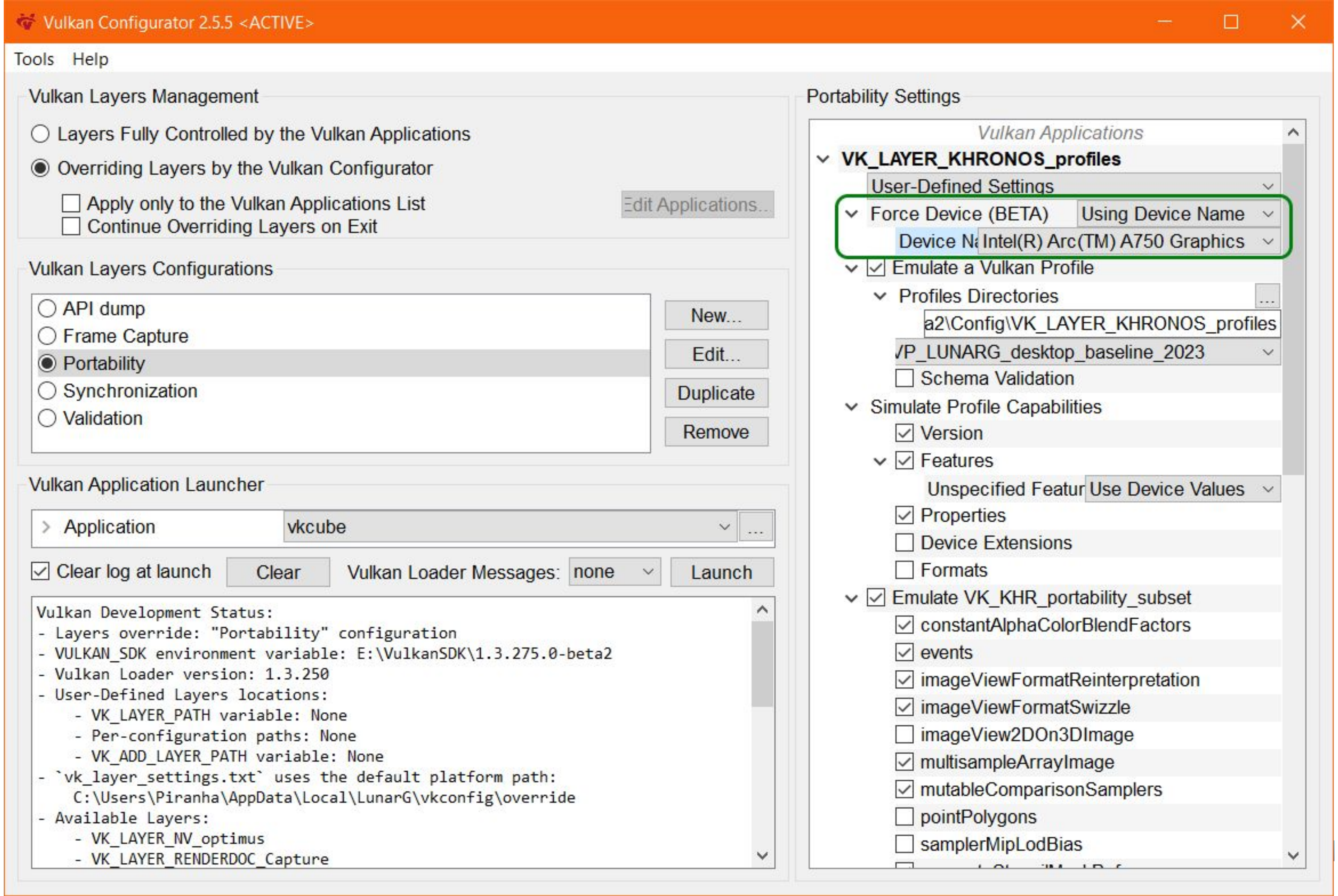
```
Vulkan Development Status:
- Layers override: "Portability" configuration
- VULKAN_SDK environment variable: E:\VulkanSDK\1.3.275.0-beta2
- Vulkan Loader version: 1.3.250
- User-Defined Layers locations:
    - VK_LAYER_PATH variable: None
    - Per-configuration paths: None
    - VK_ADD_LAYER_PATH variable: None
- `vk_layer_settings.txt` uses the default platform path:
    C:\Users\Piranha\AppData\Local\LunarG\vkconfig\override
- Available Layers:
    - VK_LAYER_NV_optimus
    - VK_LAYER_RENDERDOC_Capture
```

Portability Settings

Vulkan Applications

VK_LAYER_KHRONOS_profiles

- User-Defined Settings
- Force Device (BETA): Using Device Name
  - Device Na: Intel(R) Arc(TM) A750 Graphics
- ☑ Emulate a Vulkan Profile
  - Profiles Directories: a2\Config\VK_LAYER_KHRONOS_profiles
  - /P_LUNARG_desktop_baseline_2023
  - ☐ Schema Validation
- Simulate Profile Capabilities
  - ☑ Version
  - ☑ Features
    - Unspecified Featur: Use Device Values
  - ☑ Properties
  - ☐ Device Extensions
  - ☐ Formats
- ☑ Emulate VK_KHR_portability_subset
  - ☑ constantAlphaColorBlendFactors
  - ☑ events
  - ☑ imageViewFormatReinterpretation
  - ☑ imageViewFormatSwizzle
  - ☐ imageView2DOn3DImage
  - ☑ multisampleArrayImage
  - ☑ mutableComparisonSamplers
  - ☐ pointPolygons
  - ☐ samplerMipLodBias



Vulkan Configurator 2.5.5 <ACTIVE>

Tools Help

Vulkan Layers Management

- ○ Layers Fully Controlled by the Vulkan Applications
- ● Overriding Layers by the Vulkan Configurator
  - ☐ Apply only to the Vulkan Applications List
  - ☐ Continue Overriding Layers on Exit

Vulkan Layers Configurations

- ○ API dump
- ○ Frame Capture
- ● Portability
- ○ Synchronization
- ○ Validation

Vulkan Application Launcher

Application: vkcube

☑ Clear log at launch

Vulkan Loader Messages: none

```
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- Layers override: "Portability" configuration
- VULKAN_SDK environment variable: E:\VulkanSDK\1.3.275.0-beta2
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    C:\Users\Piranha\AppData\Local\LunarG\vkconfig\override
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    - VK_LAYER_NV_optimus
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Portability Settings

Vulkan Applications

VK_LAYER_KHRONOS_profiles

- User-Defined Settings
- Force Device (BETA): Using Device Name
  - Device Na Intel(R) Arc(TM) A750 Graphics
- ☑ Emulate a Vulkan Profile
  - Profiles Directories
    - a2\Config\VK_LAYER_KHRONOS_profiles
  - /P_LUNARG_desktop_baseline_2023
  - ☐ Schema Validation
- Simulate Profile Capabilities
  - ☑ Version
  - ☑ Features
    - Unspecified Featur Use Device Values
  - ☑ Properties
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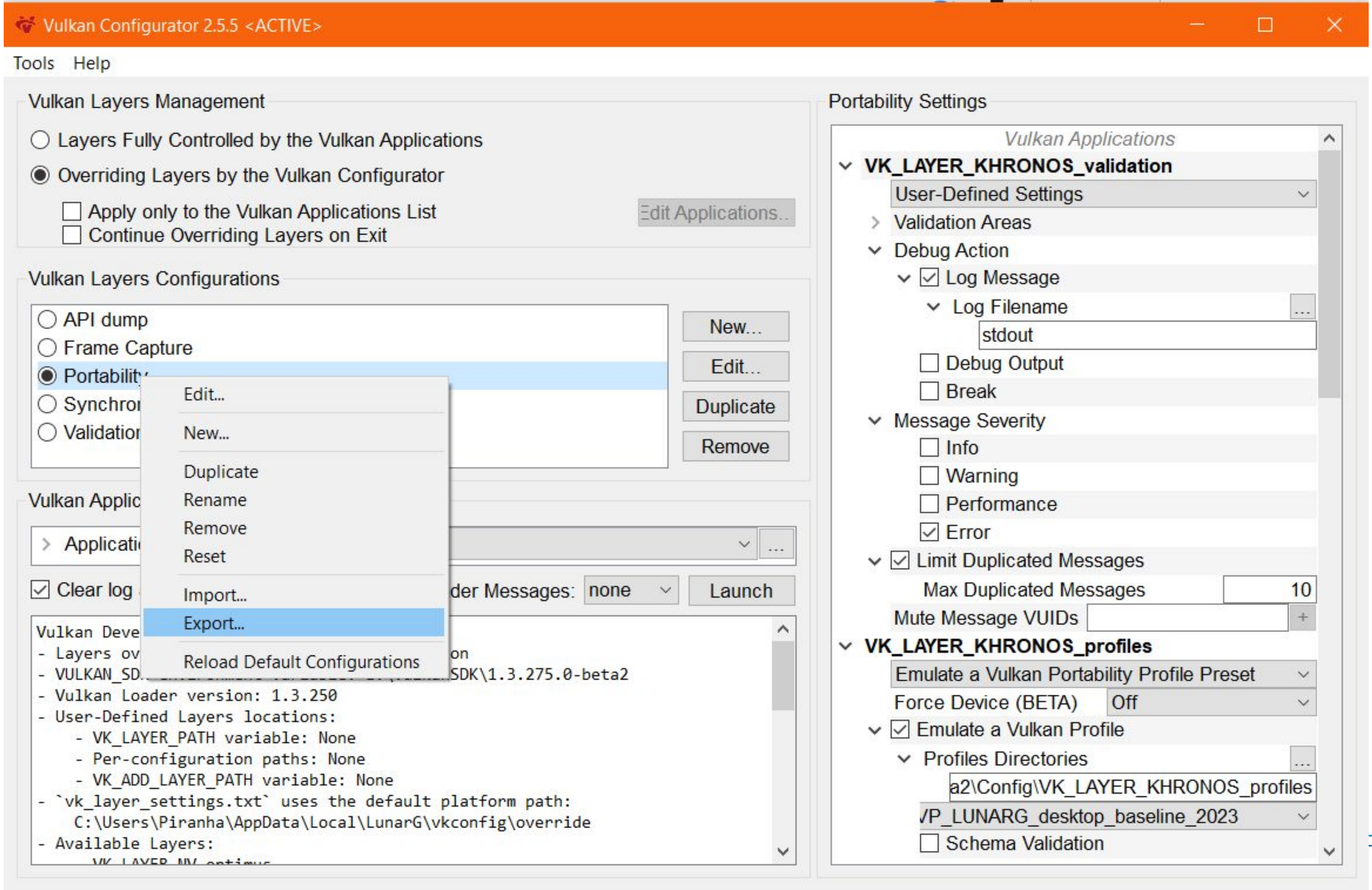

Vulkan Layers Management

- ( ) Layers Fully Controlled by the Vulkan Applications
- (●) Overriding Layers by the Vulkan Configurator
  - ☐ Apply only to the Vulkan Applications List
  - ☐ Continue Overriding Layers on Exit

Vulkan Layers Configurations

- ( ) API dump
- ( ) Frame Capture
- (●) Portabilit
- ( ) Synchro
- ( ) Validatio

Vulkan Applic

☑ Clear log

der Messages: none

```
Vulkan Deve
- Layers ov                                   on
- VULKAN_SD.                                  SDK\1.3.275.0-beta2
- Vulkan Loader version: 1.3.250
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- Available Layers:
```

Portability Settings

Vulkan Applications

VK_LAYER_KHRONOS_validation

- User-Defined Settings
- Validation Areas
- Debug Action
  - ☑ Log Message
    - Log Filename: stdout
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- Message Severity
  - ☐ Info
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- ☑ Limit Duplicated Messages
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- Mute Message VUIDs

VK_LAYER_KHRONOS_profiles

- Emulate a Vulkan Portability Profile Preset
- Force Device (BETA): Off
- ☑ Emulate a Vulkan Profile
  - Profiles Directories: a2\Config\VK_LAYER_KHRONOS_profiles
  - /P_LUNARG_desktop_baseline_2023
  - ☐ Schema Validation

Configuring the layers for C.I.

Override the layers configuration on the system:

```
$ vkconfig layers --override configuration-file.json
```

Stop overriding the layers configuration on the system:

```
$ vkconfig layers --surrender
```

Configuring the layers on the C.I. platforms

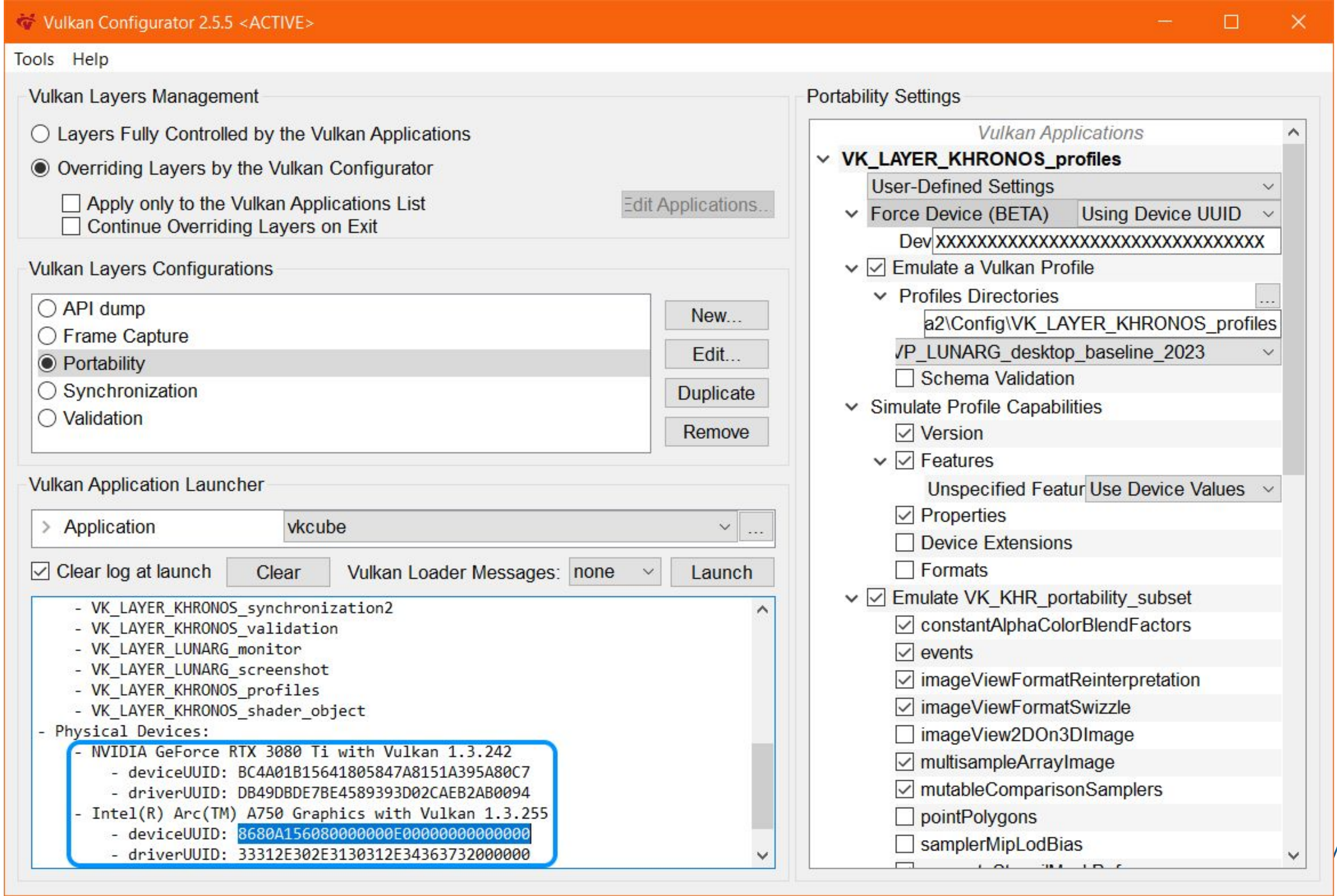
Enabling and ordering the Vulkan Layers with environment variables:

```
C:\> set VK_INSTANCE_LAYERS=VK_LAYER_KHRONOS_validation;VK_LAYER_KHRONOS_profiles
```

Stop overriding the layers configuration on the system:

```
C:\> set VK_KHRONOS_VALIDATION_VALIDATE_SYNC=true
C:\> set VK_KHRONOS_VALIDATION_DUPLICATE_MESSAGE_LIMIT=3
C:\> set VK_KHRONOS_PROFILES_PROFILE_DIRS=$VULKAN_SDK/Config/VK_LAYER_KHRONOS_profiles
C:\> set VK_KHRONOS_PROFILES_PROFILE_NAME=VP_LUNARG_desktop_baseline_2024
C:\> set VK_KHRONOS_PROFILES_FORCE_DEVICE_UUID=8680A15608000000E000000000000000
```

- Profiles layer documentation
- Validation layer documentation


Vulkan Configurator 2.5.5 <ACTIVE>

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Vulkan Layers Management

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Edit Applications...

Vulkan Layers Configurations

○ API dump
○ Frame Capture
● Portability
○ Synchronization
○ Validation

New... Edit... Duplicate Remove

Vulkan Application Launcher

Application	vkcube

☑ Clear log at launch — Clear — Vulkan Loader Messages: none — Launch

```
    - VK_LAYER_KHRONOS_synchronization2
    - VK_LAYER_KHRONOS_validation
    - VK_LAYER_LUNARG_monitor
    - VK_LAYER_LUNARG_screenshot
    - VK_LAYER_KHRONOS_profiles
    - VK_LAYER_KHRONOS_shader_object
- Physical Devices:
    - NVIDIA GeForce RTX 3080 Ti with Vulkan 1.3.242
        - deviceUUID: BC4A01B15641805847A8151A395A80C7
        - driverUUID: DB49DBDE7BE4589393D02CAEB2AB0094
    - Intel(R) Arc(TM) A750 Graphics with Vulkan 1.3.255
        - deviceUUID: 8680A156080000000E00000000000000
        - driverUUID: 33312E302E3130312E34363732000000
```

Portability Settings

Vulkan Applications

- **VK_LAYER_KHRONOS_profiles**
  - User-Defined Settings
  - Force Device (BETA): Using Device UUID
    - Dev: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  - ☑ Emulate a Vulkan Profile
    - Profiles Directories
      - a2\Config\VK_LAYER_KHRONOS_profiles
    - /P_LUNARG_desktop_baseline_2023
    - ☐ Schema Validation
  - Simulate Profile Capabilities
    - ☑ Version
    - ☑ Features
      - Unspecified Featur: Use Device Values
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    - ☐ Device Extensions
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    - ☐ imageView2DOn3DImage
    - ☑ multisampleArrayImage
    - ☑ mutableComparisonSamplers
    - ☐ pointPolygons
    - ☐ samplerMipLodBias

Configuring the layers programmatically

- Using `vkCreateInstance` API
- Using the `VK_EXT_layer_settings` extension

```
const char* val_name = "VK_LAYER_KHRONOS_validation";
const char* pfl_name = "VK_LAYER_KHRONOS_profiles";

const char* setting_profile_dirs[] = {"$VULKAN_SDK/Config/VK_LAYER_KHRONOS_profiles"};
const char* setting_profile_name[] = {"VP_LUNARG_desktop_baseline_2024"};
const VkBool32 setting_thread_safety = VK_TRUE;
const char* setting_debug_action[] = {"VK_DBG_LAYER_ACTION_LOG_MSG"};
const char* setting_report_flags[] = {"info", "warn", "perf", "error", "debug"};

const VkLayerSettingEXT settings[] = {
    {pfl_name, "profile_dirs", VK_LAYER_SETTING_TYPE_STRING_EXT, 1, &setting_profile_dirs},
    {pfl_name, "profile_name", VK_LAYER_SETTING_TYPE_STRING_EXT, 1, &setting_profile_name},
    {val_name, "thread_safety", VK_LAYER_SETTING_TYPE_BOOL32_EXT, 1, &setting_thread_safety},
    {val_name, "debug_action", VK_LAYER_SETTING_TYPE_STRING_EXT, 1, setting_debug_action},
    {val_name, "report_flags", VK_LAYER_SETTING_TYPE_STRING_EXT,
    static_cast<uint32_t>(std::size(setting_report_flags)), setting_report_flags}

const VkLayerSettingsCreateInfoEXT layer_settings_create_info = {
    VK_STRUCTURE_TYPE_LAYER_SETTINGS_CREATE_INFO_EXT, nullptr,
    static_cast<uint32_t>(std::size(settings)), settings};
```

```
const VkApplicationInfo app_info = initAppInfo();

const char* layers[] = {
        "VK_LAYER_KHRONOS_validation", "VK_LAYER_KHRONOS_profiles"};
const char* extensions[] = {"VK_EXT_layer_settings"};


const VkInstanceCreateInfo inst_create_info = {
        VK_STRUCTURE_TYPE_INSTANCE_CREATE_INFO, &layer_settings_create_info,
                                                0, &app_info,
                    static_cast<uint32_t>(std::size(layers)), layers,
   static_cast<uint32_t>(std::size(extensions)), extensions};

VkInstance instance = VK_NULL_HANDLE;
VkResult result = vkCreateInstance(&inst_create_info, nullptr, &instance);
```

Using `Vulkaninfo` to generate Device profiles

Useful for the Vulkan application developer to know on what platform the C.I. was running:

```
$ vulkaninfo --json -o ci_instance_with_native_capabilities_profile.json
$ test_runs.sh -o native_capabilities_test_results.txt
$ vkconfig layers --override configuration-file.json
$ vulkaninfo --json -o ci_instance_with_platform_capabilities_profile.json
$ test_runs.sh -o platform_capabilities_test_results.txt
```

Vulkan®

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Vulkan SDK and Ecosystem

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https://www.surveymonkey.com/r/KTBZDCM

- Survey results are tabulated
- Shared with the Vulkan Working Group
- Actions are assigned
- Results are reported

Survey closes February 26, 2024

Today's
Presentation:

https://bit.ly/3SkZZIe

bitly

Thank you!

QUESTIONS?

christophe@lunarg.com

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