

# Configuring Vulkan Layers

A consistent approach to configure layers



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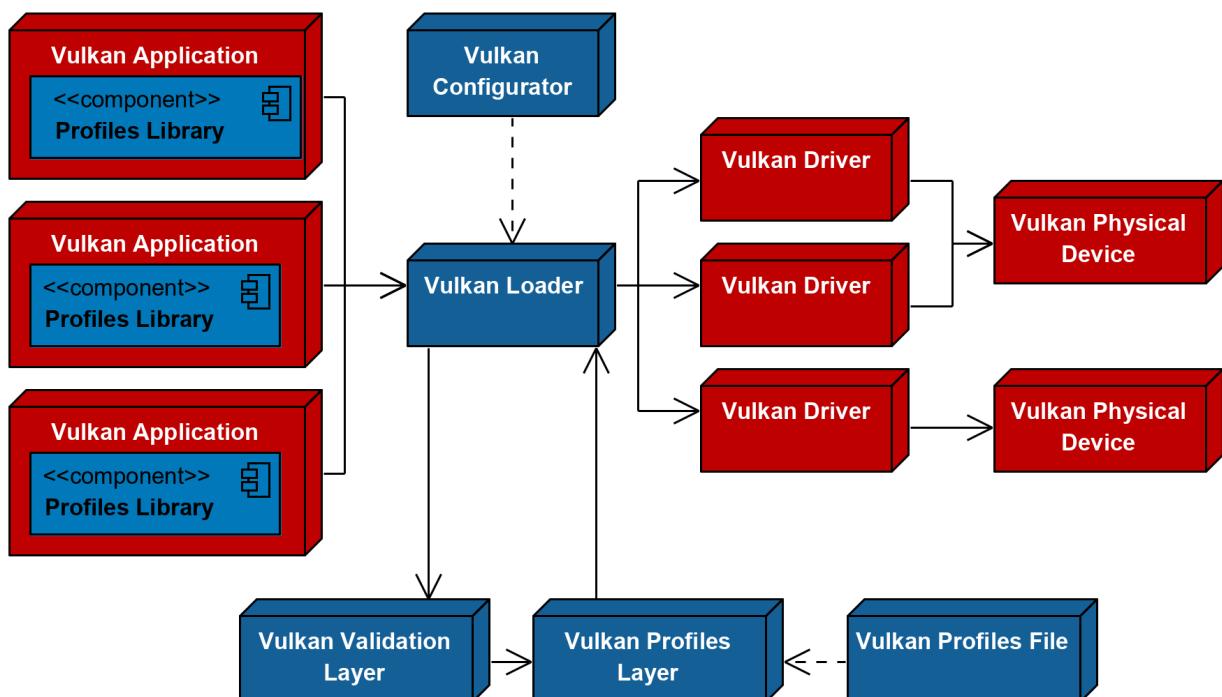
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# Configuring Vulkan Layers approaches

Vulkan supports intercepting or hooking API entry points via a layer framework. A layer can intercept all or any subset of Vulkan API entry points. Multiple layers can be chained together to cascade their functionality in the appearance of a single, larger layer.

Vulkan layers allow application developers to add functionality to Vulkan applications without modifying the application itself, e.g., validating API usages, dumping API entry points or generating screenshots of specified frames.



*Example of system configured with enabled and ordered layers on the Vulkan developer system*

## Three approaches

A *layers configuration* consists in two operations:

- Selecting and ordering layers.
- Configuring each layer themselves using layer settings.

Vulkan layers can be configured using Vulkan layer settings through three different methods to match specific Vulkan developers' workflows:

- Using Environment variables: [Loader environment variables](#) and [per-layer settings environment variables](#).
- Using dedicated Vulkan system files: [vk\\_loader\\_settings.json](#) and [vk\\_layer\\_settings.txt](#).
- Using the Vulkan API, programmably in the Vulkan application: [vkCreateInstance](#) and [VK\\_EXT\\_layer\\_settings](#) extension.

Since a setting can be set via multiple methods simultaneously here is the priority order:

1. Environment variables.
2. Using dedicated Vulkan system files.
3. Using the Vulkan API, programmably in the Vulkan application.

These three methods are implemented by the *Vulkan Layer Settings library* part of the [Vulkan-Utility-Libraries](#) repository. Any layer project that uses this library will provide these three methods to control layer settings, bringing consistency and ease of use of layers to the Vulkan community.

The *Vulkan Layer Settings library* is currently used by the [Vulkan Validation layer](#), the [Vulkan Profiles layer](#), the [Vulkan Extension layers](#) and the [LunarG Utility layers](#).

All the settings are described in the JSON layer manifest file that ships with the layer binary. When the settings are implemented in a layer using the Vulkan Layer Settings library, all the settings can be configured with all three methods.

## Generate layer settings files

Using Vulkan Configurator to generate layer settings files

## Backward Compatibility Guideline

Settings which are unknown by the layer will be ignored independently of the method. It's the responsibility of the layer developer to ensure backward compatibility with previous versions of the layer. This is to ensure the list of layer settings remain relatively stable across versions and that the responsibility of handling layer backward compatibility doesn't fall on Vulkan application developers as this could quickly become untrackable.

## Deprecation Notice

This document is describing the Vulkan Layers configuration method implemented in Vulkan Loader 1.3.304 relying on the `vk_loader_settings.json` file implemented by Vulkan Configurator 3. The previous approach relying on `vkLayer_override.json` is deprecated.

# Configuring Layers using the Vulkan API

## Enabling and ordering the layer using `vkCreateInstance()`

Applications may programmatically activate layers via the `vkCreateInstance()` entry point. This is done by setting `enabledLayerCount` and `ppEnabledLayerNames` in the `VkInstanceCreateInfo` structure.

The layer names order in `ppEnabledLayerNames` specifies the layers execution ordering from closer to the Vulkan application to closer to the Vulkan driver.

Code example to enable and order the validation and the profiles layers programmatically:

```
C/C++
const VkApplicationInfo app_info = initAppInfo();

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

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

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

In this example, the Khronos validation layer will be called *before* the Khronos profiles layer, it's called closer to the Vulkan application than the Vulkan driver.

## Configuring the layer settings using `VK_EXT_layer_settings`

Layer settings may be configured using the `VK_EXT_layer_settings` extension by initializing the `VkLayerSettingsCreateInfoEXT` structure and chaining it to the `pNext` of `VkInstanceCreateInfo` when creating a Vulkan instance.

Code example to configure the validation layer programmatically:

C/C++

```
const char* name = "VK_LAYER_KHRONOS_validation";

const VkBool32 setting_validate_core = VK_TRUE;
const VkBool32 setting_validate_sync = VK_TRUE;
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 VkBool32 setting_enable_message_limit = VK_TRUE;
const int32_t setting_duplicate_message_limit = 3;

const VkLayerSettingEXT settings[] = {
    {name, "validate_core", VK_LAYER_SETTING_TYPE_BOOL32_EXT,
     1, &setting_validate_core},
    {name, "validate_sync", VK_LAYER_SETTING_TYPE_BOOL32_EXT,
     1, &setting_validate_sync},
    {name, "thread_safety", VK_LAYER_SETTING_TYPE_BOOL32_EXT,
     1, &setting_thread_safety},
    {name, "debug_action", VK_LAYER_SETTING_TYPE_STRING_EXT,
     1, setting_debug_action},
    {name, "report_flags", VK_LAYER_SETTING_TYPE_STRING_EXT,
     static_cast<uint32_t>(std::size(setting_report_flags)),
     setting_report_flags}
    {name, "enable_message_limit", VK_LAYER_SETTING_TYPE_BOOL32_EXT,
     1, &setting_enable_message_limit},
    {name, "duplicate_message_limit", VK_LAYER_SETTING_TYPE_INT32_EXT,
     1, &setting_duplicate_message_limit}};

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[] = {name};
const char* extensions[] = {VK_EXT_LAYER_SETTINGS_EXTENSION_NAME};
```

```
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;

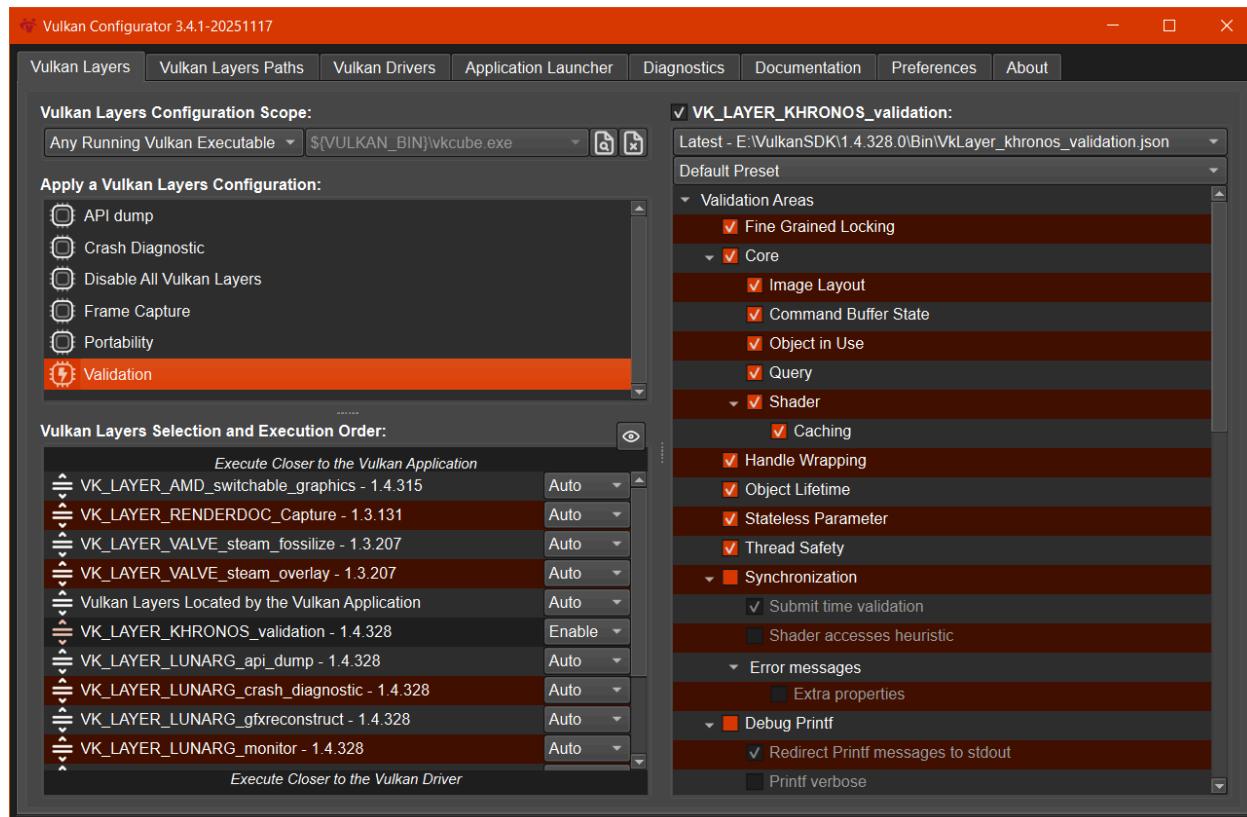
VkResult result = vkCreateInstance(
    &inst_create_info, nullptr, &instance);
```

# Configuring Layers using Vulkan system files

Layers can be configured by writing Vulkan system files, `vk_loader_settings.json` and `vk_layer_settings.txt` that are read respectively by the Vulkan Loader to select and order Vulkan layers and the Vulkan layers to select layer settings. It is the method used by *Vulkan Configurator*, a graphical user interface, to configure layers with an intuitive aspect for Vulkan developers.

*Vulkan Configurator* allows full user control of Vulkan layers, including enabling or disabling specific layers, controlling layer order, changing layer settings, etc. It supports additional functionality to select or order Vulkan physical devices, load additional Vulkan drivers and generates logs to help identifying issues.

*Vulkan Configurator* can be used using the command line to configure the system environment. Use the command `vkconfig --help` for more information.



We recommend using the *Vulkan Configurator* GUI approach for Vulkan application developers. It's the most effective approach to switch between multiple layer configurations and quickly iterate during development. Additionally, *Vulkan Configurator*

presents to the Vulkan application developers the layers found on the system and the settings of each layer, allowing Vulkan application developers to discover new functionality from the GUI without having to dig into each layer's documentation.

## **The *Vulkan Configurator* interface**

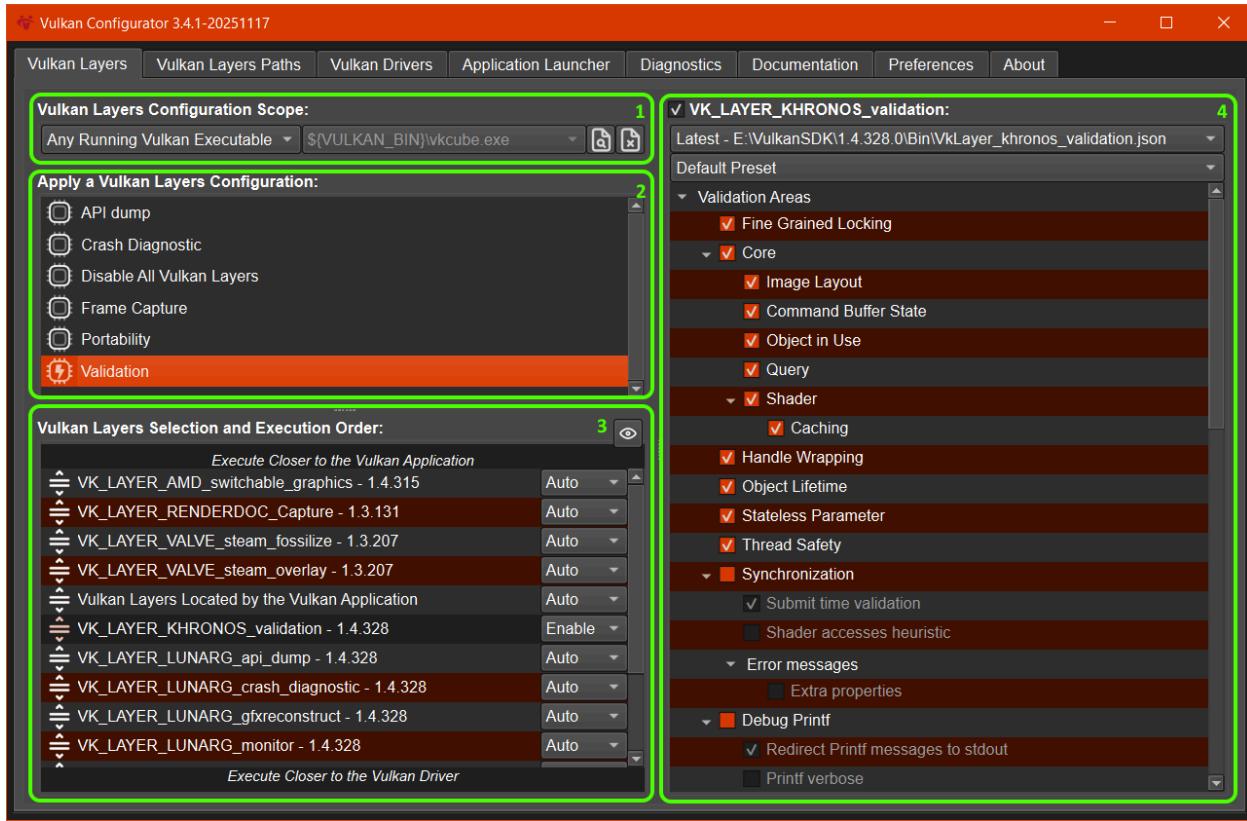
Before *Vulkan Configurator*, a Vulkan developer would have to configure the layers either programmatically or by using environment variables specified by the layers documentation, which required a significant and continuous learning curve as the Vulkan layers capabilities evolved.

### ***Vulkan Configurator* usages**

*Vulkan Configurator* was created to present the Vulkan layers with an intuitive interface enabling developers to use layer features with existing Vulkan applications, instantly and dramatically reducing development iteration time as no compilation, no learning of the new settings, and no tracking of the new features is required. The features are directly available in the GUI.

*Vulkan Configurator* usage was then extended to enable additional Vulkan drivers, configure physical devices (either force one or sort them all) and provide Vulkan system diagnostics.

## Vulkan Configurator tabs description



The Vulkan Configurator Vulkan Layers UI comprises 4 areas:

- 1) **Vulkan Layers Configuration Scope:** This area controls which Vulkan application will be affected by Vulkan Configurator whether the Vulkan Layers configuration is applied or not.

Vulkan Layers configuration can be applied to any Vulkan application running on the system or a list of selected Vulkan executables.

- 2) **Apply a Vulkan Layers Configurations:** The list of pre-configured layers configurations. Vulkan Configurator is installed with a selection of built-in layers configurations. Each built-in configuration is designed to handle a specific Vulkan application developer use case.

Using the context menu, we can create additional user-defined layer configurations for our specific use cases. We can also export the selected configuration to generate an environment variables script (to set the layers configuration settings using environment variables) and to generate a layer settings C++ helper library for `vk_EXT_layer_settings`. This library includes the

definition of all the layer settings in a .hpp file that can be directly included in Vulkan application code.

- 3) **Vulkan Layers Selection and Execution Order:** The list of layers found on the system and execution order.
- 4) **Vulkan Layer Settings:** The tree of settings for each layer. If the layers have setting presets, they are displayed just below the layer name.

## Enabling and ordering layers (`vk_loader_settings.json`)

Introduced with Vulkan Configurator 3 and Vulkan Loader 1.4.304, to control the enabled layers and the layer order, *Vulkan Configurator* generates the `vk_loader_settings.json` file, which is consumed by the Vulkan loader to enable Vulkan layers and control the order of the layers. This file also stores the user-defined paths specified in *Vulkan Configurator* to find additional layers.

### The override layer file on Linux and macOS

Unix systems store override layer file in the following paths:

- `$HOME/.local/share/vulkan/loader_settings.d/vk_loader_settings.json`

### The override layer file on Windows

Windows systems store the override layer file in the following path:

- `%HOME%\AppData\Local\LunarG\vulkan\vk_loader_settings.json`

## Configuring the layers (`vk_layer_settings.txt`)

To control the layer settings, *Vulkan Configurator* generates the `vk_layer_settings.txt` file which is consumed by the Vulkan layers and sets the setting values defined by the Vulkan developers using the UI.

By default, the Vulkan Layer Settings library requires the settings file to be named `vk_layer_settings.txt` and it will search it in the working directory of the targeted application. Hence, if a file is found in the working directory of the targeted application, the Vulkan Layer Settings library will bypass the layer settings created by *Vulkan Configurator*. If `VK_LAYER_SETTINGS_PATH` is set and is a directory, then the settings file must be a file called `vk_layer_settings.txt` in the directory given by `VK_LAYER_SETTINGS_PATH`. If `VK_LAYER_SETTINGS_PATH` is set and is not a directory, then it must point to a file (with any name) which is the layer settings file.

The settings file can be created, modified or generated by the Vulkan application developers or third party tools. The settings file consists of comment lines and settings lines. Comment lines begin with the `#` character. Settings lines have the following format:

```
<LayerName>.<setting_name> = <setting_value>
```

The list of available settings is available in the layer manifest.

Example of `vk_layer_settings.txt` file:

```
None

# The main, heavy-duty validation checks. This may be valuable early in the
# development cycle to reduce validation output while correcting
# parameter/object usage errors.
khronos_validation.validate_core = true

# Enable synchronization validation during command buffers recording. This
# feature reports resource access conflicts due to missing or incorrect
# synchronization operations between actions (Draw, Copy, Dispatch, Blit)
# reading or writing the same regions of memory.
khronos_validation.validate_sync = true

# Thread checks. In order to not degrade performance, it might be best to run
# your program with thread-checking disabled most of the time, enabling it
# occasionally for a quick sanity check or when debugging difficult
# application behaviors.
khronos_validation.thread_safety = true

# Specifies what action is to be taken when a layer reports information
khronos_validation.debug_action = VK_DBG_LAYER_ACTION_LOG_MSG

# Comma-delineated list of options specifying the types of messages to be
# reported
khronos_validation.report_flags = debug,error,perf,info,warning

# Enable limiting of duplicate messages.
khronos_validation.enable_message_limit = true

# Maximum number of times any single validation message should be reported.
khronos_validation.duplicate_message_limit = 3
```

## Layer Settings File location on Linux and macOS

Unix systems store the layer setting file in the following path:

- `$HOME/.local/share/vulkan/settings.d/vk_layer_settings.txt`

## Layer Settings File location on Windows

Windows systems store the layer setting file in the following path:

- `%HOME%\AppData\Local\LunarG\vkconfig\override\vk_layer_settings.txt`

Windows system has registry entries in the following locations:

- `HKEY_CURRENT_USER\Software\Khronos\Vulkan\Settings`

## Configuring Layers using Environment Variables

### Finding Vulkan Layers

In order to enable a Vulkan layer from the command-line, you must first make sure:

1. The layer's Manifest JSON file is found by the Vulkan Desktop Loader because it is in:
  - One of the standard operating system install paths
  - It was added using one of the layer path environment variables (`VK_LAYER_PATH` or `VK_ADD_LAYER_PATH`).
  - See the [Layer Discovery](#) section of the Vulkan Loader's [Layer Interface doc](#).
2. The layer's library file is able to be loaded by the Vulkan Desktop Loader because it is in:
  - A standard library path for the operating system
  - The library path has been updated using an operating system-specific mechanism such as:
    - Linux: adding the path to the layer's library `.so` with `LD_LIBRARY_PATH`
    - MacOS: adding the path to the layer's library `.dylib` with `DYLD_LIBRARY_PATH`
3. The layer's library file is compiled for the same target and bitdepth (32 vs 64) as the application

### Activating Specific SDK Layers

To activate layers located in a particular SDK installation, or layers built locally from source, specify the layer JSON manifest file directory using either `VK_LAYER_PATH` or `VK_ADD_LAYER_PATH`. The difference between `VK_LAYER_PATH` and `VK_ADD_LAYER_PATH` is that `VK_LAYER_PATH` overrides the system layer paths so that no system layers are loaded by default unless their path is added to the environment variable. `VK_ADD_LAYER_PATH` on the other hand, causes the loader to search the additional layer paths listed in the environment variable first, and then the standard system paths will be searched.

## Usages on each desktop platform

For example, if a Vulkan SDK is installed in C:\VulkanSDK\1.3.261.0, execute the following in a Command Window:

```
None
```

```
C:\> set VK_LAYER_PATH=C:\VulkanSDK\1.3.261.0\Bin
```

For Linux, if Vulkan SDK 1.3.261.0 was locally installed in /sdk and VULKAN\_SDK=/sdk/1.3.261.0/x86\_64:

```
None
```

```
$ export VK_LAYER_PATH=$VULKAN_SDK/lib/vulkan/layers
$ export LD_LIBRARY_PATH=$VULKAN_SDK/lib:$VULKAN_SDK/lib/vulkan/layers
```

For macOS, if Vulkan SDK 1.3.261.0 was locally installed in /sdk and VULKAN\_SDK=/sdk/1.3.261/macOS:

```
None
```

```
$ export VK_LAYER_PATH=$VULKAN_SDK/share/vulkan/explicit_layers.d
$ export DYLD_LIBRARY_PATH=$VULKAN_SDK/lib
```

## Enabling and ordering Vulkan Layers

Originally, the Vulkan Desktop Loader provided VK\_INSTANCE\_LAYERS to enable layers from the command-line. However, starting with the Vulkan Loader built against the 1.3.234 Vulkan headers, the VK\_LOADER\_LAYERS\_ENABLE environment variable was added to allow for more easily enabling Vulkan layers. The newer Loaders will continue to accept the original VK\_INSTANCE\_LAYERS environment variable for some time, but it is considered deprecated.

### Vulkan 1.3.234 Loader and Newer (VK\_LOADER\_LAYERS\_ENABLE)

The easiest way to enable a layer with a more recent drop of the Vulkan Loader is using the VK\_LOADER\_LAYERS\_ENABLE environment variable. This environment variable accepts a

case-insensitive, comma-delimited list of globs which can be used to define the layers to load.

For example, previously if you wanted to enable the Profiles layer and the Validation layer, you would have to set `VK_INSTANCE_LAYERS` equal to the full name of each layer:

```
None
```

```
VK_INSTANCE_LAYERS=VK_LAYER_KHRONOS_validation;VK_LAYER_KHRONOS_profiles
```

Now, with `VK_LOADER_LAYERS_ENABLE`, you simply can use stars where you don't want to fill in the full name:

```
None
```

```
VK_LOADER_LAYERS_ENABLE=*validation,*profiles
```

Note that order is relevant, with the initial layer being the closest to the application, and the final layer being closest to the driver. In this example, the Khronos validation layer will be called *before* the Khronos profiles layer.

## Usages on each desktop platform

Example Usage On Windows:

```
None
```

```
C:\> set VK_LOADER_LAYERS_ENABLE=*validation,*profiles
```

Example Usage On Linux/macOS:

```
None
```

```
$ export VK_LOADER_LAYERS_ENABLE=*validation,*profiles
```

More info about the new layer filtering environment variables can be found in the Layer Filtering section of the [Loader Layer Documentation](#).

## Older Vulkan Loaders (VK\_INSTANCE\_LAYERS)

Vulkan Desktop loaders version 1.3.233 and below will not accept the filtering environment variable, and so must continue using the original `VK_INSTANCE_LAYERS` environment variable.

Example Usage On Windows:

The variable should include a semicolon-separated list of layer names to activate. Note that order is relevant, with the initial layer being the closest to the application, and the final layer being closest to the driver.

```
None  
C:\> set  
VK_INSTANCE_LAYERS=VK_LAYER_KHRONOS_validation;VK_LAYER_KHRONOS_profiles
```

In this example, the Khronos validation layer will be called *before* the Khronos profiles layer. `VK_INSTANCE_LAYERS` may also be set in the system environment variables.

Example Usage On Linux/macOS:

The variable should include a colon-separated list of layer names to activate. Note that order is relevant, with the initial layer being the closest to the application, and the final layer being closest to the driver.

```
None  
$ export  
VK_INSTANCE_LAYERS=VK_LAYER_KHRONOS_validation:VK_LAYER_KHRONOS_profiles
```

In this example, the Khronos validation layer will be called *before* the Khronos profiles layer.

## Layer Settings Environment Variables

The settings can also be set using environment variables. The settings that can be set using environment variables are listed in the documentation for each supported layer. If an environment variable is set, its value takes precedence over the value in the settings file.

The environment variable names for the layer settings have multiple variants that follows the format:

- `VK_<LayerVendor>_<*LayerName*><*setting_name*>` which take precedence over:
- `VK_<*LayerName*><*setting_name*>` which take precedence over:
- `VK_<*setting_name*>`

This approach allows sharing the same setting name for potentially multiple layers but still use different values for the same setting name if this is required for the Vulkan developer use case.

## Examples

Examples of environment variable variants for a single setting:

- `VK_KHRONOS_VALIDATION_DEBUG_ACTION`
- `VK_VALIDATION_DEBUG_ACTION`
- `VK_DEBUG_ACTION`

Examples Usage on Windows:

```
None
C:\> set VK_VALIDATION_VALIDATE_CORE=true
C:\> set VK_VALIDATION_VALIDATE_SYNC=true
C:\> set VK_VALIDATION_THREAD_SAFETY=true
C:\> set VK_VALIDATION_DEBUG_ACTION=VK_DBG_LAYER_ACTION_LOG_MSG
C:\> set VK_VALIDATION_REPORT_FLAGS=debug;error;perf;info;warn
C:\> set VK_VALIDATION_ENABLE_MESSAGE_LIMIT=true
C:\> set VK_VALIDATION_DUPLICATE_MESSAGE_LIMIT=3
```

Examples Usage on Linux/macOS:

```
None
$ export VK_VALIDATION_VALIDATE_CORE=true
$ export VK_VALIDATION_VALIDATE_SYNC=true
$ export VK_VALIDATION_THREAD_SAFETY=true
$ export VK_VALIDATION_DEBUG_ACTION=VK_DBG_LAYER_ACTION_LOG_MSG
$ export VK_VALIDATION_REPORT_FLAGS=debug:error:perf:info:warn
```

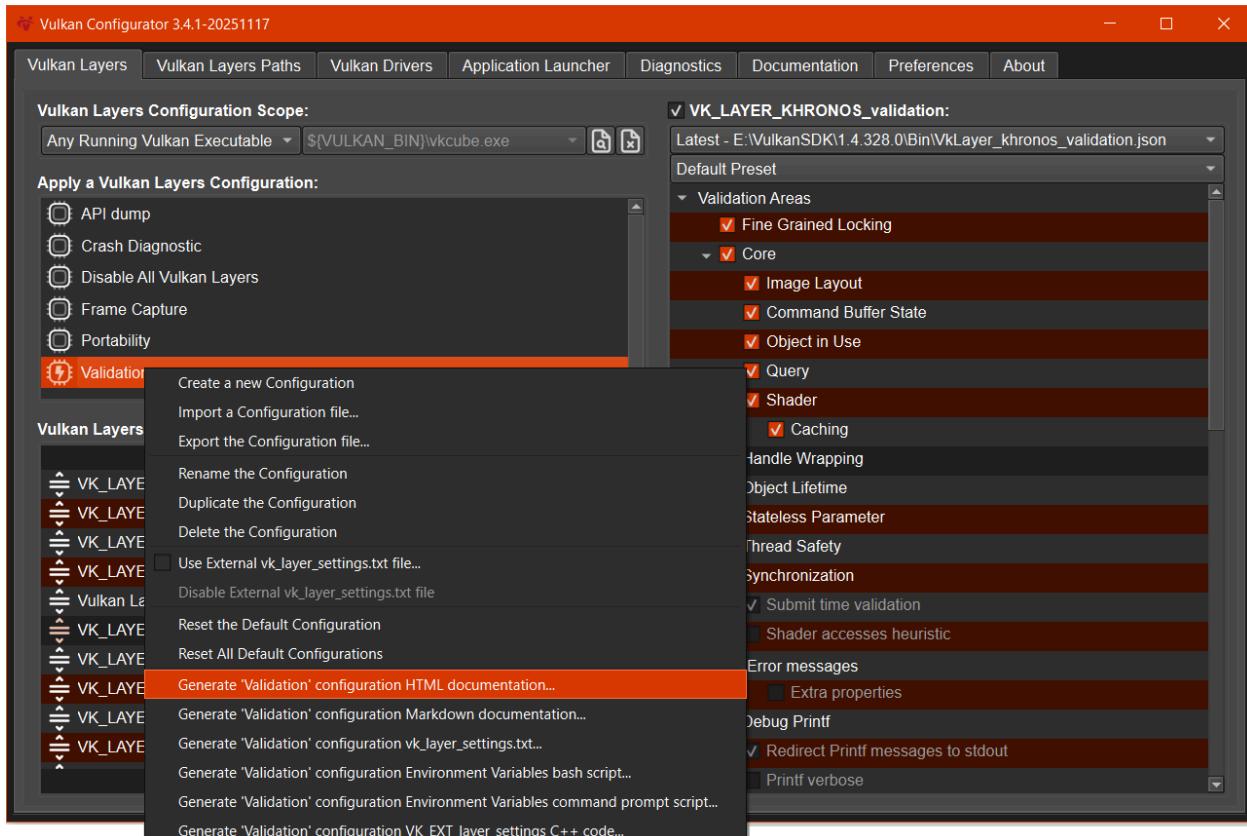
```
$ export VK_VALIDATION_ENABLE_MESSAGE_LIMIT=true
$ export VK_VALIDATION_DUPLICATE_MESSAGE_LIMIT=3
```

## Generating Vulkan layers settings files

### Generating the layer settings documentation

The layer settings documentation is generated. It includes information about the dependencies, the sub-settings, platform support of each setting, links to the features documentation, etc.

We also added code samples to show how to set each setting with all three layer settings approach.



Context menu to *generate the Validation layers configuration files*

## Generating layer settings code for each layer settings approach

Reading the documentation to set our Vulkan layer settings can be pretty tedious considering the number of settings some layers may have and considering that each new layer version may introduce new layer settings.

To resolve this issue, this project introduces the capability to generate layer settings code and scripts for each of the three layer settings methods. With *Vulkan Configurator* we can create a Vulkan layers configuration and then use this configuration to produce the generated code and scripts.

## Using `VK_EXT_layer_settings` to configure layers programmatically

The generated layer settings code is a C++ helper library that can be directly included in the Vulkan application code. It includes all the layer settings set to values that match the layer settings configuration used to generate this library. The library allows the Vulkan application developer to update the settings from the Vulkan application code.

## Generated C++ helper library example subset

```
//Khronos Validation Layer (WINDOWS_X86, WINDOWS_ARM, LINUX, MACOS, ANDROID)
// `VK_LAYER_KHRONOS_validation` settings for version 1.4.321
/*
The main, comprehensive Khronos validation layer.

Vulkan is an Explicit API, enabling direct control over how GPUs actually work. By design, minimal error checking is done inside a Vulkan driver. Applications have full control and responsibility for correct operation. Any errors in how Vulkan is used can result in a crash.

The Khronos Validation Layer can be enabled to assist development by enabling developers to verify their applications correctly use the Vulkan API.

*/
// For more information about the layer:
https://vulkan.lunarg.com/doc/sdk/latest/windows/khronos\_validation\_layer.html

struct ValidationSettingData {
    static const uint32_t VERSION = VK_MAKE_API_VERSION(1, 4, 321, 0);

    // Core (WINDOWS_X86, WINDOWS_ARM, LINUX, MACOS, ANDROID)
    // Layer setting documentation:
https://vulkan.lunarg.com/doc/sdk/latest/windows/khronos\_validation\_layer.html#validate\_core
    // For more information about the feature:
https://github.com/KhronosGroup/Vulkan-ValidationLayers/blob/main/docs/core\_checks.md
    VkBool32 validate_core = VK_TRUE;

    // Image Layout (WINDOWS_X86, WINDOWS_ARM, LINUX, MACOS, ANDROID)
    // Layer setting documentation:
https://vulkan.lunarg.com/doc/sdk/latest/windows/khronos\_validation\_layer.html#check\_image\_layout
    // This setting requires ALL of the following values:
    // - VkBool32 validate_core = VK_TRUE;
    VkBool32 check_image_layout = VK_TRUE;

    ...
}

// `LayerSettings` allows initializing layer settings from Vulkan application code.
struct LayerSettings {
    ApidumpSettingData api_dump;
    CrashdiagnosticSettingData crash_diagnostic;
    GfxreconstructSettingData gfxreconstruct;
    ScreenshotSettingData screenshot;
    ValidationSettingData validation;
    ProfilesSettingData profiles;
```

```

ShaderobjectSettingData shader_object;
Synchronization2SettingData synchronization2;

// Can be used directly with VkLayerSettingsCreateInfoEXT
const std::vector<VkLayerSettingEXT>& info();
};


```

Generated C++ helper library usage example

```

#include "vulkan_layer_settings.hpp"

...
{
    LayerSettings layer_settings;
    layer_settings.validate_core = VK_FALSE;

    std::vector<VkLayerSettingEXT> data = layer_settings.info();

    VkLayerSettingsCreateInfoEXT layer_settings_create_info {
        VK_STRUCTURE_TYPE_LAYER_SETTINGS_CREATE_INFO_EXT, nullptr,
        static_cast<int>(data.size()), &data[0]
    };
}
}


```

## Using environment variables to configure layers

The generated layer settings script can follow either the Bash or Command Prompt conventions and set all the layer settings environment variables using the value set in the selected layers configuration.

Generated Environment Variables script example subset

```

...
#! This code was generated by Vulkan Configurator 3.4.1

#! Khronos Validation Layer
#! =====
#! VK_LAYER_KHRONOS_validation - 1.4.328 (WINDOWS_X86, WINDOWS_ARM, LINUX, MACOS, ANDROID)
#! The main, comprehensive Khronos validation layer.

#! Vulkan is an Explicit API, enabling direct control over how GPUs actually
#! work. By design, minimal error checking is done inside a Vulkan driver.
#! Applications have full control and responsibility for correct operation. Any
#! errors in how Vulkan is used can result in a crash.

#! For more information about the layer:
https://vulkan.lunarg.com/doc/sdk/latest/windows/khronos\_validation\_layer.html

#! Core
#! -----
#! validate_core (WINDOWS_X86, WINDOWS_ARM, LINUX, MACOS, ANDROID)

```

```

#! The main, heavy-duty validation checks. This may be valuable early in the
#! development cycle to reduce validation output while correcting
#! parameter/object usage errors.
#! For more information about the feature:
https://github.com/KhronosGroup/Vulkan-ValidationLayers/blob/main/docs/core\_checks.md

#! This setting has sub-settings:
#! - export VK_KHRONOS_VALIDATION_CHECK_IMAGE_LAYOUT=true
#! - export VK_KHRONOS_VALIDATION_CHECK_COMMAND_BUFFER=true
#! - export VK_KHRONOS_VALIDATION_CHECK_OBJECT_IN_USE=true
#! - export VK_KHRONOS_VALIDATION_CHECK_QUERY=true
#! - export VK_KHRONOS_VALIDATION_CHECK_SHADERS=true
export VK_KHRONOS_VALIDATION_VALIDATE_CORE=true

#! Shader
#! -----
#! check_shaders (WINDOWS_X86, WINDOWS_ARM, LINUX, MACOS, ANDROID)
#! This will validate the contents of the SPIR-V which can be CPU intensive
#! during application start up. This does internal checks as well as calling
#! spirv-val. (Same effect using VK_VALIDATION_FEATURE_DISABLE_SHADERS_EXT)
#! This setting has sub-settings:
#! - export VK_KHRONOS_VALIDATION_CHECK_SHADERS_CACHING=true
#! - export VK_KHRONOS_VALIDATION_DEBUG_DISABLE_SPIRV_VAL=false
#! This setting requires ALL of the following values:
#! - export VK_KHRONOS_VALIDATION_VALIDATE_CORE=true
export VK_KHRONOS_VALIDATION_CHECK_SHADERS=true
...

```

## Using command line to generate the layer settings files

We can generate the layer settings using the Vulkan Configurator command line.

```

$ vkconfig help settings

Name
    'settings' - Command to generate layer settings files

Synopsis
    vkconfig settings
        [(--generate | -g) (html | markdown | txt | bash | bat | hpp)]
        [(--configuration | -c) [<configuration_index> | <configuration_name> | default]]
        [(--layer | -l) [<layer_name> | default]]
        [(--output-dir | -d) <output_dir>]
        [(--output | -o) <output_file>]
        [--dry-run]

Description
    Generate layer settings files either for system configuration or documentation of a layers
    configuration.

Arguments
    `[--generate (html | markdown | txt | bash | bat | hpp)]`
```

```

Specify the layer settings generation mode, the default value is 'txt':
- 'html' to generate the HTML layer settings documentation, the default filename is
  'vk_layer_settings.html'
- 'markdown' to generate the Markdown layer settings documentation, the default filename
  is 'vk_layer_settings.md'
- 'txt' to generate the `vk_layer_settings.txt` layer settings file, the default
  filename is 'vk_layer_settings.txt'
- 'bash' to generate the environment variables layer settings script for 'Bash', the
  default filename is 'vk_layer_settings.sh'
- 'bat' to generate the environment variables layer settings script for
  'command prompt', the default filename is 'vk_layer_settings.bat'
- 'hpp' to generate the C++ layer settings helper code, the default filename is
  'vk_layer_settings.hpp'

(Run 'vkconfig layers --list' to enumerate the available layers.)

`[--configuration [<configuration_index> | <configuration_name> | default]]`
  Specify the configuration name or index in the configuration list. If the argument is
  not set or set to 'default', the default layer settings will be used.

(Run 'vkconfig loader --list' to enumerate the available configurations.)

`[--layer <layer_name>]`

  Specify the layer name, if the argument is not set or set to 'default', all the found
  layers will be used.

(Run 'vkconfig layers --list' to enumerate the available layers.)

`[--output-dir | -d] <output_dir>`

  Specify the output directory path. The filename used will be the default filename if
  <output_file> is not set

  - If the 'generate' is set to 'html', the default filename is 'vk_layer_settings.html'
  - If the 'generate' is set to 'markdown', the default filename is 'vk_layer_settings.md'
  - If the 'generate' is set to 'txt', the default filename is 'vk_layer_settings.txt'
  - If the 'generate' is set to 'bash', the default filename is 'vk_layer_settings.sh'
  - If the 'generate' is set to 'bat', the default filename is 'vk_layer_settings.bat'
  - If the 'generate' is set to 'hpp', the default filename is 'vk_layer_settings.hpp'

`[('--output | -o) <output_file>]`

  Specify the output file path. If <output_dir> is set, then <output_file> must be the
  filename only.

  - If the 'generate' is set to 'html', the default filename is 'vk_layer_settings.html'
  - If the 'generate' is set to 'markdown', the default filename is 'vk_layer_settings.md'
  - If the 'generate' is set to 'txt', the default filename is 'vk_layer_settings.txt'
  - If the 'generate' is set to 'bash', the default filename is 'vk_layer_settings.sh'
  - If the 'generate' is set to 'bat', the default filename is 'vk_layer_settings.bat'
  - If the 'generate' is set to 'hpp', the default filename is 'vk_layer_settings.hpp'

`[--dry-run]`
```

Run without affecting the system and Vulkan Configurator files.

*Vulkan Configurator command line to generate layer settings files*

## Vulkan SDK generated layer settings files

The Vulkan SDK has historically shipped with a `vk_layer_settings.txt` file with all the layer settings listed with their default values. This file can easily be copied by the Vulkan developer and edited manually.

An improvement is to add more documentation for each setting in the document so that the Vulkan developer doesn't have to look at the HTML documentation to figure out the dependencies, sub-settings, etc. The file is self-documented.

With Vulkan SDK 1.4.333, the Vulkan SDK includes generated code for each layer settings approaches:

- `vulkan_layer_settings.hpp` sitting next to `vulkan.h` in the SDK which is an helper C++ library with all the layer settings initialized to the layer settings default values.
- `vk_layer_settings.sh` and `vk_layer_settings.bat` sitting next to `vk_layer_settings.txt` in the SDK which are scripts, for Bash and Command Prompt respectively, which initialize all the layer settings with the default values.

These files are generated using the following commands:

`vk_layer_settings.txt`

```
$ VK_LAYER_PATH=$VULKAN_SDK_BUILD/build/Bin
$ vkconfig settings --txt default -o ./vk_layer_settings.txt --dry-run
```

`vk_layer_settings.sh`

```
$ VK_LAYER_PATH=$VULKAN_SDK_BUILD/build/Bin
$ vkconfig settings --bash default -o ./vk_layer_settings.sh --dry-run
```

`vk_layer_settings.bat`

```
$ VK_LAYER_PATH=$VULKAN_SDK_BUILD/build/Bin
$ vkconfig settings --bat default -o ./vk_layer_settings.bat --dry-run
```

```
vulkan_layer_settings.hpp
```

```
$ VK_LAYER_PATH=$VULKAN_SDK_BUILD/build/Bin  
$ vkconfig settings --hpp default -o ./vulkan_layer_settings.hpp --dry-run
```

# Revision History

| Revision Date | SDK Release   | Comments                                                                                                                                                                                      |
|---------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| December 2026 | SDK 1.4.333.0 | <ul style="list-style-type: none"><li>- Update for Vulkan Configurator 3 and Vulkan Loader <code>vk_loader_settings.json</code></li><li>- Add Vulkan layer settings file generation</li></ul> |
| April 2024    | SDK 1.3.280.0 | <ul style="list-style-type: none"><li>- Fix <code>VK_EXT_layer_settings</code> usage example.</li></ul>                                                                                       |
| January 2024  | SDK 1.3.275.0 | <ul style="list-style-type: none"><li>- Initial release.</li></ul>                                                                                                                            |

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