

vengine

0.1.0

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Chapter 1

vengine

1.1 VEngine - Vulkan Graphics Engine

WORK IN PROGRESS!

Welcome to **VEngine**, a Vulkan-based graphics engine.

I Build this project to learn more about Vulkan and graphics programming in general. The goal is to create an efficient engine that can be used for various projects, such as games, simulations, and visualizations.

1.1.1 Features

- **Vulkan Rendering Pipeline:** Leveraging Vulkan for high-performance graphics rendering
- **Basic Camera System:** Control camera movement in the 3D space
- **Model Loading:** Import 3D models using [assimp](#)
- **Real-time debugging:** Use ImGui for real-time debugging and tool development
- **Cross-platform support** (Linux, Windows)
- **Doxygen Documentation:** Automatically generated documentation hosted on [GitHub Pages](#)

1.1.2 Planned Features:

- Ray Tracing
- Physics Integration
- Audio Integration
- Support for more input devices (e.g., mouse, game controller)
- Support for more platforms (e.g., macOS, Android, iOS, PS5 ...)

1.1.3 Build

Before building the project, make sure you update the submodules:

```
$> git submodule update --init --recursive
```

1.1.3.1 Prerequisites

Make sure you have the following dependencies installed on your system:

- CMake 3.27
- C++20
- Vulkan SDK
- X11 (Linux only)
- LLVM

If you are using a Debian-based distribution, you can install the dependencies using the following command:

```
$> ./tools/install-dependencies.sh build
```

1.1.3.2 Linux

1.1.3.2.1 Build and Run

```
$> ./tools/build.sh build  
[...]
```

This script also handle several other commands: `clean`, `format` and `doc`.

```
$> ./vengine  
[...]
```

1.1.3.3 Windows

1.1.3.3.1 Build and Run

I build the project with `CLion`, also works with `Visual Studio`. I'm using the Visual studio toolchain with `ninja`.

You should create your own CMake profile depending on your configuration. Basic configuration should run the following commands:

```
$> cmake -G "Visual Studio 17 2022" .  
$> cmake --build . --config Release
```

1.1.4 Key Bindings

The following keyboard controls are currently available for interacting with the engine:

Key	Description
Z	Move forward
S	Move backward
Q	Move left
D	Move right
SHIFT	Move down
SPACE	Move up
↑	Look up
↓	Look down
←	Look left
→	Look right
à	Show debug windows

1.1.5 Documentation

The documentation is generated using [Doxygen](#). You can access the latest version on the [GitHub Pages](#).

1.1.6 External Libraries

- [Assimp](#): Open Asset Import Library to load various 3D model formats into the engine.
- [Doxygen Awesome CSS](#): A custom CSS theme for Doxygen documentation.
- [GLFW](#): For creating windows, receiving input, and managing OpenGL and Vulkan contexts.
- [GLM](#): A header-only C++ mathematics library for 3D transformations, vectors, and matrices, compatible with OpenGL and Vulkan.
- [ImGui](#): Immediate Mode Graphical User Interface for real-time debugging and tool development.
- [stb](#): A set of single-file public domain libraries for graphics, image loading, and more.

These libraries are included directly into the project to simplify dependency management. Be sure to initialize and update the submodules when cloning the repository:

1.1.7 Commit Norms

Commit Type	Description
build	Changes that affect the build system or external dependencies (npm, make, etc.)
ci	Changes related to integration files and scripts or configuration (Travis, Ansible, BrowserStack, etc.)
feat	Addition of a new feature
fix	Bug fix
perf	Performance improvements
refactor	Modification that neither adds a new feature nor improves performance
style	Change that does not affect functionality or semantics (indentation, formatting, adding space, renaming a variable, etc.)
docs	Writing or updating documentation
test	Addition or modification of tests

1.1.8 License

This project is licensed under the MIT License - see the [LICENSE](#) file for details.

1.1.9 Acknowledgements

Special thanks to [Brendan Galea](#) for inspiration and resources related to Vulkan development.

Chapter 2

Namespace Index

2.1 Namespace List

Here is a list of all namespaces with brief descriptions:

ven	13
---------------------	-------	--------------------

Chapter 3

Hierarchical Index

3.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

ven::ARenderSystemBase	21
ven::ObjectRenderSystem	164
ven::PointLightRenderSystem	173
ven::Buffer	27
ven::DescriptorPool::Builder	40
ven::DescriptorSetLayout::Builder	45
ven::Model::Builder	49
ven::Camera	51
ven::Clock	62
ven::Gui::ClockData	66
ven::Colors	67
ven::DescriptorPool	79
ven::DescriptorSetLayout	84
ven::DescriptorWriter	88
ven::Device	92
ven::Engine	111
ven::EventManager	117
ven::FrameInfo	121
ven::Gui::funcs	124
ven::GlobalUbo	126
ven::Gui	128
std::hash< ven::Model::Vertex >	138
ven::KeyAction	139
ven::KeyMappings	141
ven::Light	144
ven::LightPushConstantData	148
ven::Model	150
ven::Object	155
ven::ObjectBufferData	162
ven::ObjectPushConstantData	163
ven::PipelineConfigInfo	168
ven::PointLightData	172
ven::QueueFamilyIndices	177
ven::Renderer	179
ven::SceneManager	189

ven::Shaders	197
ven::SwapChain	203
ven::SwapChainSupportDetails	214
ven::Texture	216
ven::Transform3D	225
ven::Model::Vertex	227
ven::Window	230

Chapter 4

Class Index

4.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

ven::ARenderSystemBase	Abstract class for render system base	21
ven::Buffer	Class for buffer	27
ven::DescriptorPool::Builder	. . . . .	40
ven::DescriptorSetLayout::Builder	. . . . .	45
ven::Model::Builder	. . . . .	49
ven::Camera	Class for camera	51
ven::Clock	Class for clock	62
ven::Gui::ClockData	. . . . .	66
ven::Colors	Class for colors	67
ven::DescriptorPool	Class for descriptor pool	79
ven::DescriptorSetLayout	Class for descriptor set layout	84
ven::DescriptorWriter	Class for descriptor writer	88
ven::Device	Class for device	92
ven::Engine	Class for engine	111
ven::EventManager	Class for event manager	117
ven::FrameInfo	. . . . .	121
ven::Gui::funcs	. . . . .	124
ven::GlobalUbo	. . . . .	126
ven::Gui	Class for Gui	128
std::hash< ven::Model::Vertex >>	. . . . .	138
ven::KeyAction	. . . . .	139
ven::KeyMappings	. . . . .	141
ven::Light	Class for light	144

ven::LightPushConstantData	148
ven::Model	
Class for model	150
ven::Object	
Class for object	155
ven::ObjectBufferData	162
ven::ObjectPushConstantData	163
ven::ObjectRenderSystem	
Class for object render system	164
ven::PipelineConfigInfo	168
ven::PointLightData	172
ven::PointLightRenderSystem	
Class for point light system	173
ven::QueueFamilyIndices	177
ven::Renderer	
Class for renderer	179
ven::SceneManager	
Class for object manager	189
ven::Shaders	
Class for shaders	197
ven::SwapChain	
Class for swap chain	203
ven::SwapChainSupportDetails	214
ven::Texture	
Class for texture	216
ven::Transform3D	
Class for 3D transformation	225
ven::Model::Vertex	227
ven::Window	
Class for window	230

Chapter 5

File Index

5.1 File List

Here is a list of all files with brief descriptions:

/home/runner/work/VEngine/VEngine/assets/shaders/ fragment_point_light.frag	237
/home/runner/work/VEngine/VEngine/assets/shaders/ fragment_shader.frag	237
/home/runner/work/VEngine/VEngine/assets/shaders/ vertex_point_light.vert	238
/home/runner/work/VEngine/VEngine/assets/shaders/ vertex_shader.vert	239
/home/runner/work/VEngine/VEngine/include/VEngine/Core/ Device.hpp This file contains the Device class	240
/home/runner/work/VEngine/VEngine/include/VEngine/Core/ Engine.hpp This file contains the Engine class	242
/home/runner/work/VEngine/VEngine/include/VEngine/Core/ EventManager.hpp This file contains the EventManager class	244
/home/runner/work/VEngine/VEngine/include/VEngine/Core/ FrameInfo.hpp This file contains the FrameInfo class	247
/home/runner/work/VEngine/VEngine/include/VEngine/Core/ Gui.hpp This file contains the ImGuiWindowManager class	249
/home/runner/work/VEngine/VEngine/include/VEngine/Core/ Window.hpp This file contains the Window class	259
/home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/ ABase.hpp This file contains the ARenderSystemBase class	251
/home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/ Object.hpp This file contains the ObjectRenderSystem class	253
/home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/ PointLight.hpp This file contains the PointLightRenderSystem class	257
/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/ Buffer.hpp This file contains the Buffer class	261
/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/ Model.hpp This file contains the Model class	271
/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/ Renderer.hpp This file contains the Renderer class	274
/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/ Shaders.hpp This file contains the Shader class	276
/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/ SwapChain.hpp This file contains the Shader class	278
/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/ Texture.hpp This file contains the Texture class	281
/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/ Pool.hpp This file contains the DescriptorPool class	265

/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/ SetLayout.hpp	
This file contains the DescriptorSetLayout class	267
/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/ Writer.hpp	
This file contains the DescriptorsWriter class	269
/home/runner/work/VEngine/VEngine/include/VEngine/Scene/ Camera.hpp	
This file contains the Camera class	283
/home/runner/work/VEngine/VEngine/include/VEngine/Scene/ Manager.hpp	
This file contains the SceneManager class	288
/home/runner/work/VEngine/VEngine/include/VEngine/Scene/ Transform3D.hpp	
This file contains the Transform3D class	290
/home/runner/work/VEngine/VEngine/include/VEngine/Scene/Entities/ Light.hpp	
This file contains the Light class	286
/home/runner/work/VEngine/VEngine/include/VEngine/Scene/Entities/ Object.hpp	
This file contains the Object class	255
/home/runner/work/VEngine/VEngine/include/VEngine/Utils/ Clock.hpp	
This file contains the Clock class	291
/home/runner/work/VEngine/VEngine/include/VEngine/Utils/ Colors.hpp	293
/home/runner/work/VEngine/VEngine/include/VEngine/Utils/ HashCombine.hpp	297
/home/runner/work/VEngine/VEngine/include/VEngine/Utils/ Utils.hpp	
This file contains utils for VEngine	298
/home/runner/work/VEngine/VEngine/src/ main.cpp	348
/home/runner/work/VEngine/VEngine/src/Core/ device.cpp	299
/home/runner/work/VEngine/VEngine/src/Core/ engine.cpp	309
/home/runner/work/VEngine/VEngine/src/Core/ eventManager.cpp	311
/home/runner/work/VEngine/VEngine/src/Core/ window.cpp	324
/home/runner/work/VEngine/VEngine/src/Core/GUI/ init.cpp	313
/home/runner/work/VEngine/VEngine/src/Core/GUI/ render.cpp	315
/home/runner/work/VEngine/VEngine/src/Core/RenderSystems/ base.cpp	321
/home/runner/work/VEngine/VEngine/src/Core/RenderSystems/ object.cpp	322
/home/runner/work/VEngine/VEngine/src/Core/RenderSystems/ pointLight.cpp	323
/home/runner/work/VEngine/VEngine/src/Gfx/ buffer.cpp	325
/home/runner/work/VEngine/VEngine/src/Gfx/ model.cpp	330
/home/runner/work/VEngine/VEngine/src/Gfx/ renderer.cpp	334
/home/runner/work/VEngine/VEngine/src/Gfx/ shaders.cpp	336
/home/runner/work/VEngine/VEngine/src/Gfx/ swapChain.cpp	338
/home/runner/work/VEngine/VEngine/src/Gfx/ texture.cpp	344
/home/runner/work/VEngine/VEngine/src/Gfx/Descriptors/ pool.cpp	326
/home/runner/work/VEngine/VEngine/src/Gfx/Descriptors/ setLayout.cpp	327
/home/runner/work/VEngine/VEngine/src/Gfx/Descriptors/ writer.cpp	329
/home/runner/work/VEngine/VEngine/src/Scene/ camera.cpp	350
/home/runner/work/VEngine/VEngine/src/Scene/ manager.cpp	352
/home/runner/work/VEngine/VEngine/src/Utils/ clock.cpp	354

Chapter 6

Namespace Documentation

6.1 ven Namespace Reference

Classes

- class [ARenderSystemBase](#)
Abstract class for render system base.
- class [Buffer](#)
Class for buffer.
- class [Camera](#)
Class for camera.
- class [Clock](#)
Class for clock.
- class [Colors](#)
Class for colors.
- class [DescriptorPool](#)
Class for descriptor pool.
- class [DescriptorSetLayout](#)
Class for descriptor set layout.
- class [DescriptorWriter](#)
Class for descriptor writer.
- class [Device](#)
Class for device.
- class [Engine](#)
Class for engine.
- class [EventManager](#)
Class for event manager.
- struct [FrameInfo](#)
- struct [GlobalUbo](#)
- class [Gui](#)
Class for [Gui](#).
- struct [KeyAction](#)
- struct [KeyMappings](#)
- class [Light](#)
Class for light.
- struct [LightPushConstantData](#)

- class [Model](#)
Class for model.
- class [Object](#)
Class for object.
- struct [ObjectBufferData](#)
- struct [ObjectPushConstantData](#)
- class [ObjectRenderSystem](#)
Class for object render system.
- struct [PipelineConfigInfo](#)
- struct [PointLightData](#)
- class [PointLightRenderSystem](#)
Class for point light system.
- struct [QueueFamilyIndices](#)
- class [Renderer](#)
Class for renderer.
- class [SceneManager](#)
Class for object manager.
- class [Shaders](#)
Class for shaders.
- class [SwapChain](#)
Class for swap chain.
- struct [SwapChainSupportDetails](#)
- class [Texture](#)
Class for texture.
- class [Transform3D](#)
Class for 3D transformation.
- class [Window](#)
Class for window.

Typedefs

- using [TimePoint](#) = std::chrono::time_point<std::chrono::high_resolution_clock>

Enumerations

- enum [GUI_STATE](#) : uint8_t { [SHOW_EDITOR](#) = 0 , [SHOW_PLAYER](#) = 1 , [HIDDEN](#) = 2 }
- enum [ENGINE_STATE](#) : uint8_t { [EDITOR](#) = 0 , [PLAYER](#) = 1 , [PAUSED](#) = 2 , [EXIT](#) = 3 }

Functions

- template<typename T , typename... Rest>
void [hashCombine](#) (std::size_t &seed, const T &v, const Rest &... rest)

Variables

- static constexpr float [EPSILON](#) = std::numeric_limits<float>::epsilon()
- static constexpr [KeyMappings](#) [DEFAULT_KEY_MAPPINGS](#) {}
- static constexpr float [DEFAULT_AMBIENT_LIGHT_INTENSITY](#) = .2F
- static constexpr glm::vec4 [DEFAULT_AMBIENT_LIGHT_COLOR](#) = {glm::vec3(1.F), [DEFAULT_AMBIENT_LIGHT_INTENSITY](#)}
- static constexpr uint16_t [DESCRIPTOR_COUNT](#) = 1000
- static constexpr uint32_t [DEFAULT_WIDTH](#) = 1920
- static constexpr uint32_t [DEFAULT_HEIGHT](#) = 1080
- static constexpr std::string_view [DEFAULT_TITLE](#) = "VEngine"
- static constexpr uint32_t [DEFAULT_MAX_SETS](#) = 1000
- static constexpr VkClearColorValue [DEFAULT_CLEAR_COLOR](#) = {{0.0F, 0.0F, 0.0F, 1.0F}}
- static constexpr VkClearDepthStencilValue [DEFAULT_CLEAR_DEPTH](#) = {1.0F, 0}
- static constexpr std::string_view [SHADERS_BIN_PATH](#) = "build/shaders/"
- static constexpr int [MAX_FRAMES_IN_FLIGHT](#) = 2
- static constexpr glm::vec3 [DEFAULT_POSITION](#) {0.F, 0.F, -2.5F}
- static constexpr glm::vec3 [DEFAULT_ROTATION](#) {0.F, 0.F, 0.F}
- static constexpr float [DEFAULT_FOV](#) = glm::radians(50.0F)
- static constexpr float [DEFAULT_NEAR](#) = 0.1F
- static constexpr float [DEFAULT_FAR](#) = 100.F
- static constexpr float [DEFAULT_MOVE_SPEED](#) = 3.F
- static constexpr float [DEFAULT_LOOK_SPEED](#) = 1.5F
- static constexpr float [DEFAULT_LIGHT_INTENSITY](#) = .2F
- static constexpr float [DEFAULT_LIGHT_RADIUS](#) = 0.1F
- static constexpr float [DEFAULT_SHININESS](#) = 32.F
- static constexpr glm::vec4 [DEFAULT_LIGHT_COLOR](#) = {glm::vec3(1.F), [DEFAULT_LIGHT_INTENSITY](#)}
- static constexpr uint8_t [MAX_LIGHTS](#) = 10
- static constexpr uint16_t [MAX_OBJECTS](#) = 1000
- static constexpr float [COLOR_MAX](#) = 255.0F

6.1.1 Typedef Documentation

6.1.1.1 TimePoint

using [ven::TimePoint](#) = std::chrono::time_point<std::chrono::high_resolution_clock>

Definition at line 13 of file [Clock.hpp](#).

6.1.2 Enumeration Type Documentation

6.1.2.1 ENGINE_STATE

enum [ven::ENGINE_STATE](#) : uint8_t

Enumerator

EDITOR	
PLAYER	
PAUSED	
EXIT	

Definition at line 13 of file [Utils.hpp](#).

6.1.2.2 GUI_STATE

enum [ven::GUI_STATE](#) : uint8_t

Enumerator

SHOW_EDITOR	
SHOW_PLAYER	
HIDDEN	

Definition at line 19 of file [Gui.hpp](#).

6.1.3 Function Documentation

6.1.3.1 hashCombine()

```
template<typename T , typename... Rest>
void ven::hashCombine (
    std::size_t & seed,
    const T & v,
    const Rest &... rest)
```

Definition at line 14 of file [HashCombine.hpp](#).

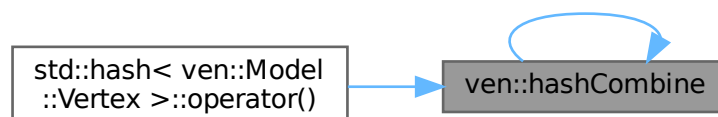
References [hashCombine\(\)](#).

Referenced by [hashCombine\(\)](#), and [std::hash< ven::Model::Vertex >::operator\(\)\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



6.1.4 Variable Documentation

6.1.4.1 COLOR_MAX

```
float ven::COLOR_MAX = 255.0F [static], [constexpr]
```

Definition at line 15 of file [Colors.hpp](#).

6.1.4.2 DEFAULT_AMBIENT_LIGHT_COLOR

```
glm::vec4 ven::DEFAULT_AMBIENT_LIGHT_COLOR = {glm::vec3(1.F), DEFAULT_AMBIENT_LIGHT_INTENSITY}  
[static], [constexpr]
```

Definition at line 19 of file [FrameInfo.hpp](#).

6.1.4.3 DEFAULT_AMBIENT_LIGHT_INTENSITY

```
float ven::DEFAULT_AMBIENT_LIGHT_INTENSITY = .2F [static], [constexpr]
```

Definition at line 18 of file [FrameInfo.hpp](#).

Referenced by [ven::Gui::rendererSection\(\)](#).

6.1.4.4 DEFAULT_CLEAR_COLOR

```
VkClearColorValue ven::DEFAULT_CLEAR_COLOR = {{0.0F, 0.0F, 0.0F, 1.0F}} [static], [constexpr]
```

Definition at line 16 of file [Renderer.hpp](#).

6.1.4.5 DEFAULT_CLEAR_DEPTH

```
VkClearDepthStencilValue ven::DEFAULT_CLEAR_DEPTH = {1.0F, 0} [static], [constexpr]
```

Definition at line 17 of file [Renderer.hpp](#).

6.1.4.6 DEFAULT_FAR

```
float ven::DEFAULT_FAR = 100.F [static], [constexpr]
```

Definition at line 18 of file [Camera.hpp](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

6.1.4.7 DEFAULT_FOV

```
float ven::DEFAULT_FOV = glm::radians(50.0F) [static], [constexpr]
```

Definition at line 16 of file [Camera.hpp](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

6.1.4.8 DEFAULT_HEIGHT

```
uint32_t ven::DEFAULT_HEIGHT = 1080 [static], [constexpr]
```

Definition at line 18 of file [Window.hpp](#).

6.1.4.9 DEFAULT_KEY_MAPPINGS

```
KeyMappings ven::DEFAULT_KEY_MAPPINGS {} [static], [constexpr]
```

Definition at line 35 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::handleEvents\(\)](#), and [ven::EventManager::moveCamera\(\)](#).

6.1.4.10 DEFAULT_LIGHT_COLOR

```
glm::vec4 ven::DEFAULT_LIGHT_COLOR = {glm::vec3(1.F), DEFAULT\_LIGHT\_INTENSITY} [static],  
[constexpr]
```

Definition at line 16 of file [Light.hpp](#).

6.1.4.11 DEFAULT_LIGHT_INTENSITY

```
float ven::DEFAULT_LIGHT_INTENSITY = .2F [static], [constexpr]
```

Definition at line 13 of file [Light.hpp](#).

Referenced by [ven::Gui::lightsSection\(\)](#).

6.1.4.12 DEFAULT_LIGHT_RADIUS

```
float ven::DEFAULT_LIGHT_RADIUS = 0.1F [static], [constexpr]
```

Definition at line 14 of file [Light.hpp](#).

6.1.4.13 DEFAULT_LOOK_SPEED

```
float ven::DEFAULT_LOOK_SPEED = 1.5F [static], [constexpr]
```

Definition at line 21 of file [Camera.hpp](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

6.1.4.14 DEFAULT_MAX_SETS

```
uint32_t ven::DEFAULT_MAX_SETS = 1000 [static], [constexpr]
```

Definition at line 15 of file [Pool.hpp](#).

6.1.4.15 DEFAULT_MOVE_SPEED

```
float ven::DEFAULT_MOVE_SPEED = 3.F [static], [constexpr]
```

Definition at line 20 of file [Camera.hpp](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

6.1.4.16 DEFAULT_NEAR

```
float ven::DEFAULT_NEAR = 0.1F [static], [constexpr]
```

Definition at line 17 of file [Camera.hpp](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

6.1.4.17 DEFAULT_POSITION

```
glm::vec3 ven::DEFAULT_POSITION {0.F, 0.F, -2.5F} [static], [constexpr]
```

Definition at line 13 of file [Camera.hpp](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

6.1.4.18 DEFAULT_ROTATION

```
glm::vec3 ven::DEFAULT_ROTATION {0.F, 0.F, 0.F} [static], [constexpr]
```

Definition at line 14 of file [Camera.hpp](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

6.1.4.19 DEFAULT_SHININESS

```
float ven::DEFAULT_SHININESS = 32.F [static], [constexpr]
```

Definition at line 15 of file [Light.hpp](#).

Referenced by [ven::Gui::lightsSection\(\)](#).

6.1.4.20 DEFAULT_TITLE

```
std::string_view ven::DEFAULT_TITLE = "VEngine" [static], [constexpr]
```

Definition at line 19 of file [Window.hpp](#).

6.1.4.21 DEFAULT_WIDTH

```
uint32_t ven::DEFAULT_WIDTH = 1920 [static], [constexpr]
```

Definition at line 17 of file [Window.hpp](#).

6.1.4.22 DESCRIPTOR_COUNT

```
uint16_t ven::DESCRIPTOR_COUNT = 1000 [static], [constexpr]
```

Definition at line 17 of file [Gui.hpp](#).

Referenced by [ven::Gui::init\(\)](#).

6.1.4.23 EPSILON

```
float ven::EPSILON = std::numeric_limits<float>::epsilon() [static], [constexpr]
```

Definition at line 34 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

6.1.4.24 MAX_FRAMES_IN_FLIGHT

```
int ven::MAX_FRAMES_IN_FLIGHT = 2 [static], [constexpr]
```

Definition at line 15 of file [SwapChain.hpp](#).

Referenced by [ven::Renderer::createCommandBuffers\(\)](#), [ven::SwapChain::createSyncObjects\(\)](#), [ven::Renderer::endFrame\(\)](#), [ven::Engine::Engine\(\)](#), [ven::Engine::mainLoop\(\)](#), [ven::SwapChain::submitCommandBuffers\(\)](#), and [ven::SwapChain::~~SwapChain\(\)](#).

6.1.4.25 MAX_LIGHTS

```
uint8_t ven::MAX_LIGHTS = 10 [static], [constexpr]
```

Definition at line 18 of file [Light.hpp](#).

Referenced by [ven::SceneManager::createLight\(\)](#).

6.1.4.26 MAX_OBJECTS

```
uint16_t ven::MAX_OBJECTS = 1000 [static], [constexpr]
```

Definition at line 17 of file [Object.hpp](#).

Referenced by [ven::SceneManager::createObject\(\)](#), and [ven::SceneManager::SceneManager\(\)](#).

6.1.4.27 SHADERS_BIN_PATH

```
std::string_view ven::SHADERS_BIN_PATH = "build/shaders/" [static], [constexpr]
```

Definition at line 13 of file [Shaders.hpp](#).

Referenced by [ven::ObjectRenderSystem::ObjectRenderSystem\(\)](#), and [ven::PointLightRenderSystem::PointLightRenderSystem\(\)](#).

Chapter 7

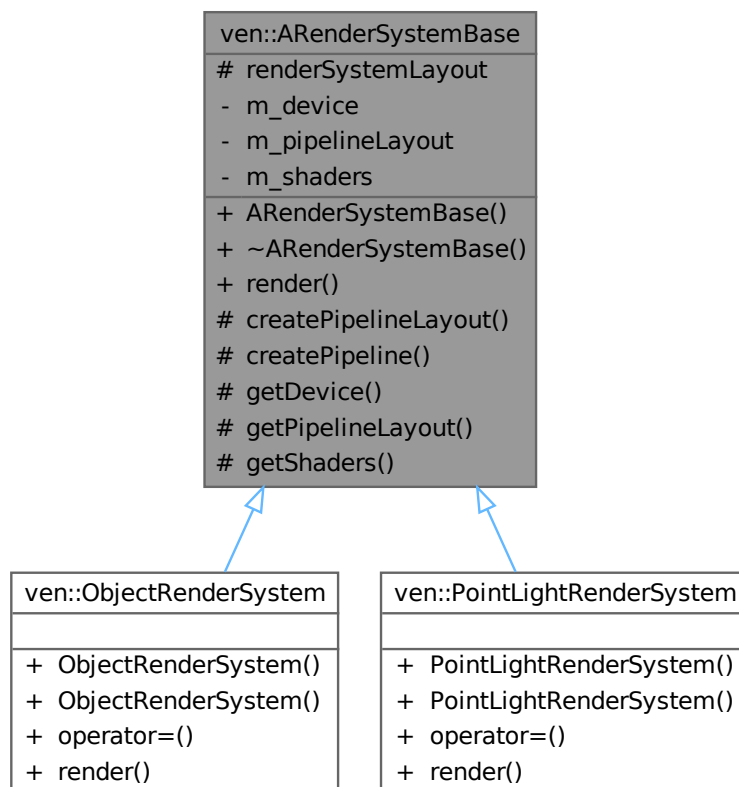
Class Documentation

7.1 ven::ARenderSystemBase Class Reference

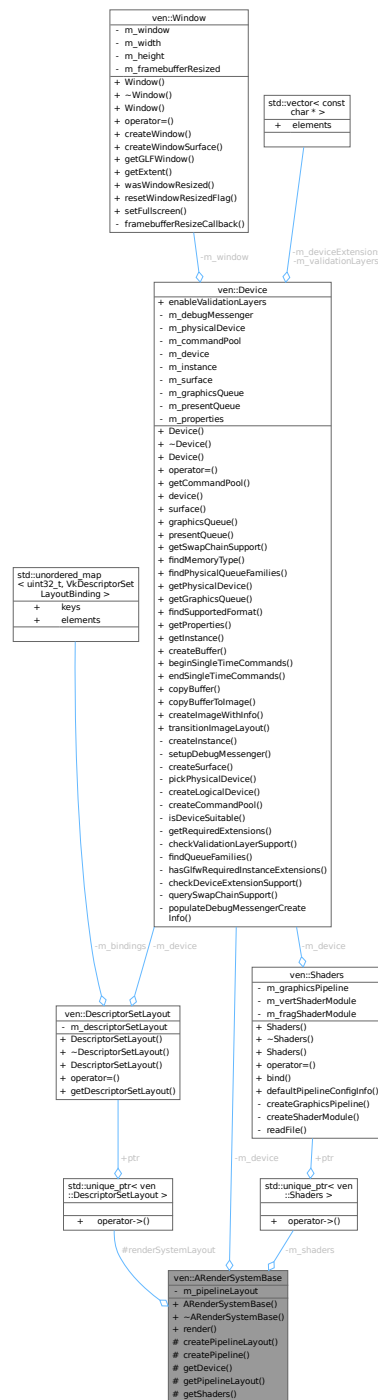
Abstract class for render system base.

```
#include <ABase.hpp>
```

Inheritance diagram for ven::ARenderSystemBase:



Collaboration diagram for `ven::ARenderSystemBase`:



Public Member Functions

- [ARenderSystemBase](#) ([Device](#) &device)
- virtual `~ARenderSystemBase` ()
- virtual void `render` (const [FrameInfo](#) &frameInfo) const =0

Protected Member Functions

- void [createPipelineLayout](#) (VkDescriptorSetLayout globalSetLayout, uint32_t pushConstantSize)
- void [createPipeline](#) (VkRenderPass renderPass, const std::string &shadersVertPath, const std::string &shadersFragPath, bool isLight)
- [Device](#) & [getDevice](#) () const
- VkPipelineLayout [getPipelineLayout](#) () const
- const std::unique_ptr< [Shaders](#) > & [getShaders](#) () const

Protected Attributes

- std::unique_ptr< [DescriptorSetLayout](#) > [renderSystemLayout](#)

Private Attributes

- [Device](#) & [m_device](#)
- VkPipelineLayout [m_pipelineLayout](#) {nullptr}
- std::unique_ptr< [Shaders](#) > [m_shaders](#)

7.1.1 Detailed Description

Abstract class for render system base.

Definition at line 20 of file [ABase.hpp](#).

7.1.2 Constructor & Destructor Documentation

7.1.2.1 ARenderSystemBase()

```
ven::ARenderSystemBase::ARenderSystemBase (
    Device & device) [inline], [explicit]
```

Definition at line 24 of file [ABase.hpp](#).

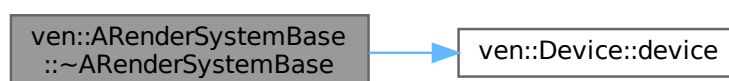
7.1.2.2 ~ARenderSystemBase()

```
virtual ven::ARenderSystemBase::~~ARenderSystemBase () [inline], [virtual]
```

Definition at line 25 of file [ABase.hpp](#).

References [ven::Device::device\(\)](#), [m_device](#), and [m_pipelineLayout](#).

Here is the call graph for this function:



7.1.3 Member Function Documentation

7.1.3.1 createPipeline()

```
void ven::ARenderSystemBase::createPipeline (
    VkRenderPass renderPass,
    const std::string & shadersVertPath,
    const std::string & shadersFragPath,
    bool isLight) [protected]
```

Definition at line 35 of file [base.cpp](#).

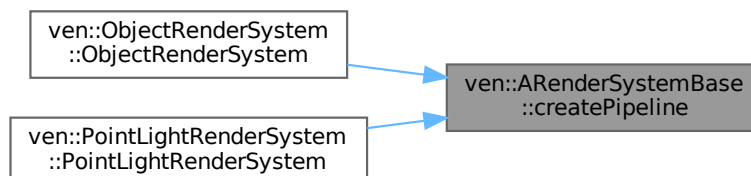
References [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

Referenced by [ven::ObjectRenderSystem::ObjectRenderSystem\(\)](#), and [ven::PointLightRenderSystem::PointLightRenderSystem\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.1.3.2 createPipelineLayout()

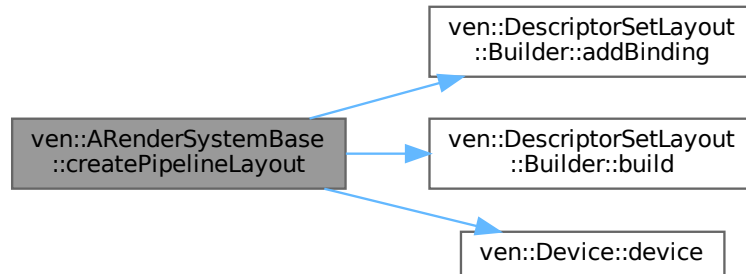
```
void ven::ARenderSystemBase::createPipelineLayout (
    VkDescriptorSetLayout globalSetLayout,
    uint32_t pushConstantSize) [protected]
```

Definition at line 3 of file [base.cpp](#).

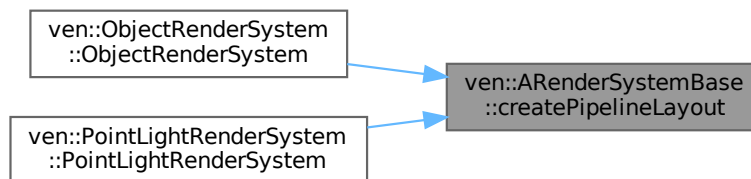
References [ven::DescriptorSetLayout::Builder::addBinding\(\)](#), [ven::DescriptorSetLayout::Builder::build\(\)](#), [ven::Device::device\(\)](#), [m_device](#), [m_pipelineLayout](#), and [renderSystemLayout](#).

Referenced by [ven::ObjectRenderSystem::ObjectRenderSystem\(\)](#), and [ven::PointLightRenderSystem::PointLightRenderSystem\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.1.3.3 getDevice()

```
Device & ven::ARenderSystemBase::getDevice () const [inline], [nodiscard], [protected]
```

Definition at line 34 of file [ABase.hpp](#).

References [m_device](#).

7.1.3.4 getPipelineLayout()

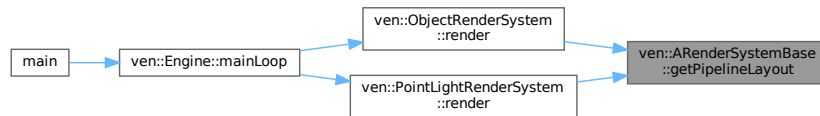
```
VkPipelineLayout ven::ARenderSystemBase::getPipelineLayout () const [inline], [nodiscard], [protected]
```

Definition at line 35 of file [ABase.hpp](#).

References [m_pipelineLayout](#).

Referenced by [ven::ObjectRenderSystem::render\(\)](#), and [ven::PointLightRenderSystem::render\(\)](#).

Here is the caller graph for this function:



7.1.3.5 getShaders()

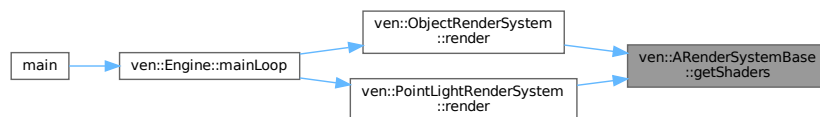
```
const std::unique_ptr< Shaders > & ven::ARenderSystemBase::getShaders () const [inline],
[nodiscard], [protected]
```

Definition at line 36 of file [ABase.hpp](#).

References [m_shaders](#).

Referenced by [ven::ObjectRenderSystem::render\(\)](#), and [ven::PointLightRenderSystem::render\(\)](#).

Here is the caller graph for this function:



7.1.3.6 render()

```
virtual void ven::ARenderSystemBase::render (
    const FrameInfo & frameInfo) const [pure virtual]
```

Implemented in [ven::ObjectRenderSystem](#), and [ven::PointLightRenderSystem](#).

7.1.4 Member Data Documentation

7.1.4.1 m_device

```
Device& ven::ARenderSystemBase::m_device [private]
```

Definition at line 42 of file [ABase.hpp](#).

Referenced by [createPipelineLayout\(\)](#), [getDevice\(\)](#), and [~ARenderSystemBase\(\)](#).

7.1.4.2 m_pipelineLayout

```
VkPipelineLayout ven::ARenderSystemBase::m_pipelineLayout {nullptr} [private]
```

Definition at line 43 of file [ABase.hpp](#).

Referenced by [createPipelineLayout\(\)](#), [getPipelineLayout\(\)](#), and [~ARenderSystemBase\(\)](#).

7.1.4.3 m_shaders

```
std::unique_ptr<Shaders> ven::ARenderSystemBase::m_shaders [private]
```

Definition at line 44 of file [ABase.hpp](#).

Referenced by [getShaders\(\)](#).

7.1.4.4 renderSystemLayout

```
std::unique_ptr<DescriptorSetLayout> ven::ARenderSystemBase::renderSystemLayout [protected]
```

Definition at line 38 of file [ABase.hpp](#).

Referenced by [createPipelineLayout\(\)](#), and [ven::ObjectRenderSystem::render\(\)](#).

The documentation for this class was generated from the following files:

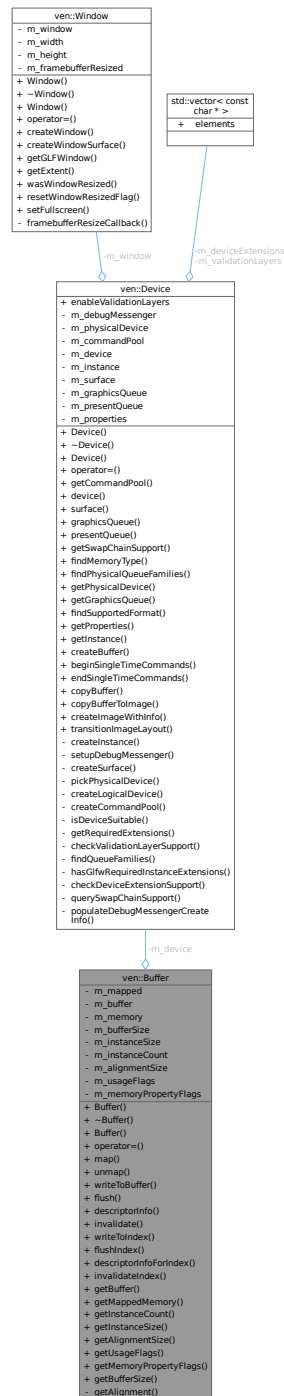
- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/ABase.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Core/RenderSystems/base.cpp](#)

7.2 ven::Buffer Class Reference

Class for buffer.

```
#include <Buffer.hpp>
```

Collaboration diagram for ven::Buffer:



Public Member Functions

- [Buffer](#) ([Device](#) &device, VkDeviceSize instanceSize, uint32_t instanceCount, VkBufferUsageFlags usageFlags, VkMemoryPropertyFlags memoryPropertyFlags, VkDeviceSize minOffsetAlignment=1)
- [~Buffer](#) ()
- [Buffer](#) (const [Buffer](#) &)=delete
- [Buffer](#) & [operator=](#) (const [Buffer](#) &)=delete

- `VkResult` `map` (`VkDeviceSize` size=`VK_WHOLE_SIZE`, `VkDeviceSize` offset=0)
Map a memory range of this buffer.
- `void` `unmap` ()
Unmap a mapped memory range.
- `void` `writeToBuffer` (`const void *`data, `VkDeviceSize` size=`VK_WHOLE_SIZE`, `VkDeviceSize` offset=0) `const`
Copies the specified data to the mapped buffer.
- `VkResult` `flush` (`VkDeviceSize` size=`VK_WHOLE_SIZE`, `VkDeviceSize` offset=0) `const`
Flush a memory range of the buffer to make it visible to the device.
- `VkDescriptorBufferInfo` `descriptorInfo` (`const VkDeviceSize` size=`VK_WHOLE_SIZE`, `const VkDeviceSize` offset=0) `const`
Create a buffer info descriptor.
- `VkResult` `invalidate` (`VkDeviceSize` size=`VK_WHOLE_SIZE`, `VkDeviceSize` offset=0) `const`
Invalidate a memory range of the buffer to make it visible to the host.
- `void` `writeToIndex` (`const void *`data, `const VkDeviceSize` index) `const`
*Copies "instanceSize" bytes of data to the mapped buffer at an offset of index * alignmentSize.*
- `VkResult` `flushIndex` (`const VkDeviceSize` index) `const`
*Flush the memory range at index * alignmentSize of the buffer to make it visible to the device.*
- `VkDescriptorBufferInfo` `descriptorInfoForIndex` (`const VkDeviceSize` index) `const`
Create a buffer info descriptor.
- `VkResult` `invalidateIndex` (`const VkDeviceSize` index) `const`
Invalidate a memory range of the buffer to make it visible to the host.
- `VkBuffer` `getBuffer` () `const`
- `void *` `getMappedMemory` () `const`
- `uint32_t` `getInstanceCount` () `const`
- `VkDeviceSize` `getInstanceSize` () `const`
- `VkDeviceSize` `getAlignmentSize` () `const`
- `VkBufferUsageFlags` `getUsageFlags` () `const`
- `VkMemoryPropertyFlags` `getMemoryPropertyFlags` () `const`
- `VkDeviceSize` `getBufferSize` () `const`

Static Private Member Functions

- `static VkDeviceSize` `getAlignment` (`const VkDeviceSize` instanceSize, `const VkDeviceSize` minOffset↵
Alignment)
Returns the minimum instance size required to be compatible with devices minOffsetAlignment.

Private Attributes

- `Device &` `m_device`
- `void *` `m_mapped` = `nullptr`
- `VkBuffer` `m_buffer` = `VK_NULL_HANDLE`
- `VkDeviceMemory` `m_memory` = `VK_NULL_HANDLE`
- `VkDeviceSize` `m_bufferSize`
- `VkDeviceSize` `m_instanceSize`
- `uint32_t` `m_instanceCount`
- `VkDeviceSize` `m_alignmentSize`
- `VkBufferUsageFlags` `m_usageFlags`
- `VkMemoryPropertyFlags` `m_memoryPropertyFlags`

7.2.1 Detailed Description

Class for buffer.

Definition at line 20 of file [Buffer.hpp](#).

7.2.2 Constructor & Destructor Documentation

7.2.2.1 Buffer() [1/2]

```
ven::Buffer::Buffer (
    Device & device,
    VkDeviceSize instanceSize,
    uint32_t instanceCount,
    VkBufferUsageFlags usageFlags,
    VkMemoryPropertyFlags memoryPropertyFlags,
    VkDeviceSize minOffsetAlignment = 1)
```

Definition at line 5 of file [buffer.cpp](#).

References [ven::Device::createBuffer\(\)](#), [m_alignmentSize](#), [m_buffer](#), [m_bufferSize](#), [m_instanceCount](#), [m_memory](#), [m_memoryPropertyFlags](#), and [m_usageFlags](#).

Here is the call graph for this function:



7.2.2.2 ~Buffer()

```
ven::Buffer::~~Buffer ()
```

Definition at line 11 of file [buffer.cpp](#).

7.2.2.3 Buffer() [2/2]

```
ven::Buffer::Buffer (
    const Buffer & ) [delete]
```

7.2.3 Member Function Documentation

7.2.3.1 descriptorInfo()

```
VkDescriptorBufferInfo ven::Buffer::descriptorInfo (
    const VkDeviceSize size = VK_WHOLE_SIZE,
    const VkDeviceSize offset = 0) const [inline], [nodiscard]
```

Create a buffer info descriptor.

Parameters

<i>size</i>	(Optional) Size of the memory range of the descriptor
<i>offset</i>	(Optional) Byte offset from beginning

Returns

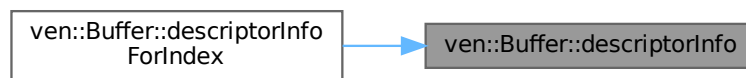
VkDescriptorBufferInfo of specified offset and range

Definition at line 76 of file [Buffer.hpp](#).

References [m_buffer](#).

Referenced by [descriptorInfoForIndex\(\)](#).

Here is the caller graph for this function:



7.2.3.2 descriptorInfoForIndex()

```
VkDescriptorBufferInfo ven::Buffer::descriptorInfoForIndex (  
    const VkDeviceSize index) const [inline], [nodiscard]
```

Create a buffer info descriptor.

Parameters

<i>index</i>	Specifies the region given by <code>index * alignmentSize</code>
--------------	--

Returns

VkDescriptorBufferInfo for instance at index

Definition at line 115 of file [Buffer.hpp](#).

References [descriptorInfo\(\)](#), and [m_alignmentSize](#).

Here is the call graph for this function:



7.2.3.3 flush()

```
VkResult ven::Buffer::flush (
    VkDeviceSize size = VK_WHOLE_SIZE,
    VkDeviceSize offset = 0) const
```

Flush a memory range of the buffer to make it visible to the device.

Note

Only required for non-coherent memory

Parameters

<i>size</i>	(Optional) Size of the memory range to flush. Pass VK_WHOLE_SIZE to flush the complete buffer range.
<i>offset</i>	(Optional) Byte offset from beginning

Returns

VkResult of the flush call

Definition at line 45 of file [buffer.cpp](#).

Referenced by [flushIndex\(\)](#).

Here is the caller graph for this function:



7.2.3.4 flushIndex()

```
VkResult ven::Buffer::flushIndex (
    const VkDeviceSize index) const [inline]
```

Flush the memory range at `index * alignmentSize` of the buffer to make it visible to the device.

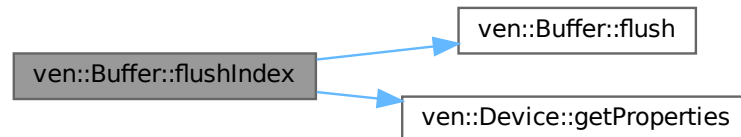
Parameters

<i>index</i>	Used in offset calculation
--------------	----------------------------

Definition at line 105 of file [Buffer.hpp](#).

References [flush\(\)](#), [ven::Device::getProperties\(\)](#), [m_alignmentSize](#), and [m_device](#).

Here is the call graph for this function:



7.2.3.5 getAlignment()

```
static VkDeviceSize ven::Buffer::getAlignment (
    const VkDeviceSize instanceSize,
    const VkDeviceSize minOffsetAlignment) [inline], [static], [private]
```

Returns the minimum instance size required to be compatible with devices `minOffsetAlignment`.

Parameters

<i>instanceSize</i>	The size of an instance
<i>minOffsetAlignment</i>	The minimum required alignment, in bytes, for the offset member (eg <code>minUniformBufferOffsetAlignment</code>)

Returns

VkResult of the buffer mapping call

Definition at line 147 of file [Buffer.hpp](#).

7.2.3.6 getAlignmentSize()

```
VkDeviceSize ven::Buffer::getAlignmentSize () const [inline], [nodiscard]
```

Definition at line 132 of file [Buffer.hpp](#).

References [m_alignmentSize](#).

7.2.3.7 getBuffer()

```
VkBuffer ven::Buffer::getBuffer () const [inline], [nodiscard]
```

Definition at line 128 of file [Buffer.hpp](#).

References [m_buffer](#).

7.2.3.8 getBufferSize()

```
VkDeviceSize ven::Buffer::getBufferSize () const [inline], [nodiscard]
```

Definition at line 135 of file [Buffer.hpp](#).

References [m_bufferSize](#).

7.2.3.9 getInstanceCount()

```
uint32_t ven::Buffer::getInstanceCount () const [inline], [nodiscard]
```

Definition at line 130 of file [Buffer.hpp](#).

References [m_instanceCount](#).

7.2.3.10 getInstanceSize()

```
VkDeviceSize ven::Buffer::getInstanceSize () const [inline], [nodiscard]
```

Definition at line 131 of file [Buffer.hpp](#).

References [m_instanceSize](#).

7.2.3.11 getMappedMemory()

```
void * ven::Buffer::getMappedMemory () const [inline], [nodiscard]
```

Definition at line 129 of file [Buffer.hpp](#).

References [m_mapped](#).

7.2.3.12 getMemoryPropertyFlags()

```
VkMemoryPropertyFlags ven::Buffer::getMemoryPropertyFlags () const [inline], [nodiscard]
```

Definition at line 134 of file [Buffer.hpp](#).

References [m_memoryPropertyFlags](#).

7.2.3.13 getUsageFlags()

```
VkBufferUsageFlags ven::Buffer::getUsageFlags () const [inline], [nodiscard]
```

Definition at line 133 of file [Buffer.hpp](#).

References [m_usageFlags](#).

7.2.3.14 invalidate()

```
VkResult ven::Buffer::invalidate (
    VkDeviceSize size = VK_WHOLE_SIZE,
    VkDeviceSize offset = 0) const [nodiscard]
```

Invalidate a memory range of the buffer to make it visible to the host.

Note

Only required for non-coherent memory

Parameters

<i>size</i>	(Optional) Size of the memory range to invalidate. Pass VK_WHOLE_SIZE to invalidate the complete buffer range.
<i>offset</i>	(Optional) Byte offset from beginning

Returns

VkResult of the invalidate call

Definition at line 55 of file [buffer.cpp](#).

Referenced by [invalidateIndex\(\)](#).

Here is the caller graph for this function:



7.2.3.15 invalidateIndex()

```
VkResult ven::Buffer::invalidateIndex (
    const VkDeviceSize index) const [inline], [nodiscard]
```

Invalidate a memory range of the buffer to make it visible to the host.

Note

Only required for non-coherent memory

Parameters

<i>index</i>	Specifies the region to invalidate: $\text{index} * \text{alignmentSize}$
--------------	---

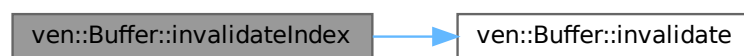
Returns

VkResult of the invalidate call

Definition at line 126 of file [Buffer.hpp](#).

References [invalidate\(\)](#), and [m_alignmentSize](#).

Here is the call graph for this function:



7.2.3.16 map()

```
VkResult ven::Buffer::map (
    VkDeviceSize size = VK_WHOLE_SIZE,
    VkDeviceSize offset = 0)
```

Map a memory range of this buffer.

If successful, mapped points to the specified buffer range.

Parameters

<i>size</i>	(Optional) Size of the memory range to map. Pass VK_WHOLE_SIZE to map the complete buffer range.
<i>offset</i>	(Optional) Byte offset from beginning

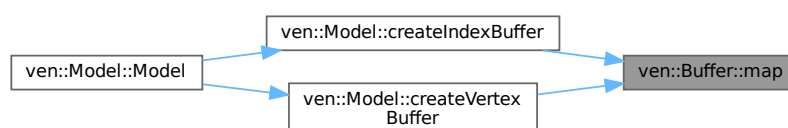
Returns

VkResult of the buffer mapping call

Definition at line 18 of file [buffer.cpp](#).

Referenced by [ven::Model::createIndexBuffer\(\)](#), and [ven::Model::createVertexBuffer\(\)](#).

Here is the caller graph for this function:



7.2.3.17 operator=()

```
Buffer & ven::Buffer::operator= (
    const Buffer & ) [delete]
```

7.2.3.18 unmap()

```
void ven::Buffer::unmap ()
```

Unmap a mapped memory range.

Note

Does not return a result as vkUnmapMemory can't fail

Definition at line 24 of file [buffer.cpp](#).

7.2.3.19 writeToBuffer()

```
void ven::Buffer::writeToBuffer (
    const void * data,
    VkDeviceSize size = VK_WHOLE_SIZE,
    VkDeviceSize offset = 0) const
```

Copies the specified data to the mapped buffer.

Default value writes whole buffer range

Parameters

<i>data</i>	Pointer to the data to copy
<i>size</i>	(Optional) Size of the data to copy. Pass VK_WHOLE_SIZE to flush the complete buffer range.
<i>offset</i>	(Optional) Byte offset from beginning of mapped region

Definition at line 32 of file [buffer.cpp](#).

Referenced by [writeToIndex\(\)](#).

Here is the caller graph for this function:



7.2.3.20 writeToIndex()

```
void ven::Buffer::writeToIndex (
    const void * data,
    const VkDeviceSize index) const [inline]
```

Copies "instanceSize" bytes of data to the mapped buffer at an offset of index * alignmentSize.

Parameters

<i>data</i>	Pointer to the data to copy
<i>index</i>	Used in offset calculation

Definition at line 98 of file [Buffer.hpp](#).

References [m_alignmentSize](#), [m_instanceSize](#), and [writeToBuffer\(\)](#).

Here is the call graph for this function:



7.2.4 Member Data Documentation

7.2.4.1 m_alignmentSize

```
VkDeviceSize ven::Buffer::m_alignmentSize [private]
```

Definition at line 157 of file [Buffer.hpp](#).

Referenced by [Buffer\(\)](#), [descriptorInfoForIndex\(\)](#), [flushIndex\(\)](#), [getAlignmentSize\(\)](#), [invalidateIndex\(\)](#), and [writeToIndex\(\)](#).

7.2.4.2 m_buffer

```
VkBuffer ven::Buffer::m_buffer = VK_NULL_HANDLE [private]
```

Definition at line 151 of file [Buffer.hpp](#).

Referenced by [Buffer\(\)](#), [descriptorInfo\(\)](#), and [getBuffer\(\)](#).

7.2.4.3 m_bufferSize

```
VkDeviceSize ven::Buffer::m_bufferSize [private]
```

Definition at line 154 of file [Buffer.hpp](#).

Referenced by [Buffer\(\)](#), and [getBufferSize\(\)](#).

7.2.4.4 m_device

```
Device& ven::Buffer::m_device [private]
```

Definition at line 149 of file [Buffer.hpp](#).

Referenced by [flushIndex\(\)](#).

7.2.4.5 m_instanceCount

```
uint32_t ven::Buffer::m_instanceCount [private]
```

Definition at line 156 of file [Buffer.hpp](#).

Referenced by [Buffer\(\)](#), and [getInstanceCount\(\)](#).

7.2.4.6 m_instanceSize

```
VkDeviceSize ven::Buffer::m_instanceSize [private]
```

Definition at line 155 of file [Buffer.hpp](#).

Referenced by [getInstanceSize\(\)](#), and [writeToIndex\(\)](#).

7.2.4.7 m_mapped

```
void* ven::Buffer::m_mapped = nullptr [private]
```

Definition at line 150 of file [Buffer.hpp](#).

Referenced by [getMappedMemory\(\)](#).

7.2.4.8 m_memory

```
VkDeviceMemory ven::Buffer::m_memory = VK_NULL_HANDLE [private]
```

Definition at line 152 of file [Buffer.hpp](#).

Referenced by [Buffer\(\)](#).

7.2.4.9 m_memoryPropertyFlags

```
VkMemoryPropertyFlags ven::Buffer::m_memoryPropertyFlags [private]
```

Definition at line 159 of file [Buffer.hpp](#).

Referenced by [Buffer\(\)](#), and [getMemoryPropertyFlags\(\)](#).

7.2.4.10 m_usageFlags

```
VkBufferUsageFlags ven::Buffer::m_usageFlags [private]
```

Definition at line 158 of file [Buffer.hpp](#).

Referenced by [Buffer\(\)](#), and [getUsageFlags\(\)](#).

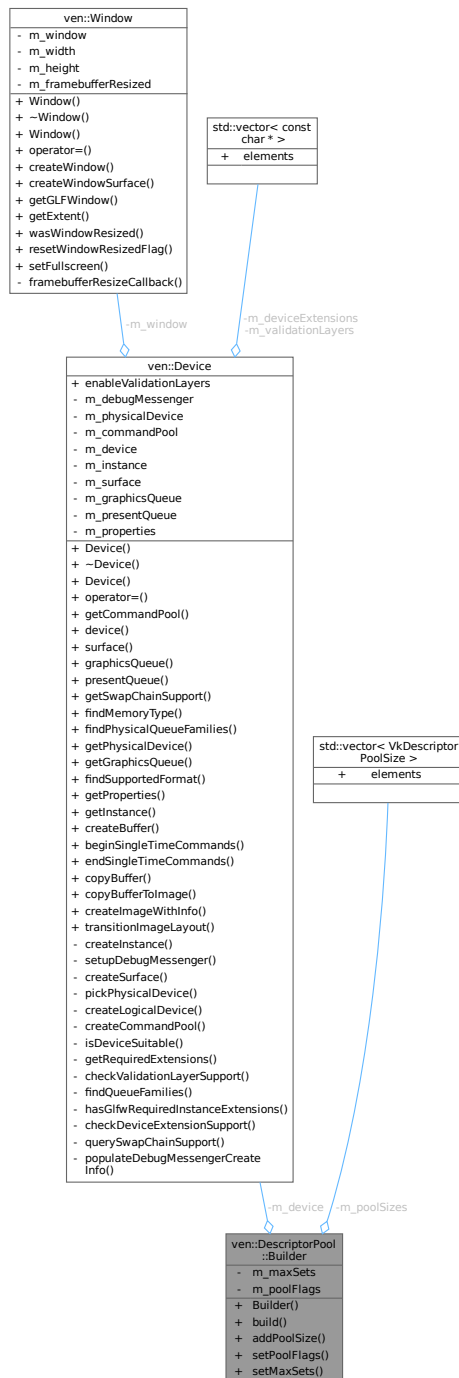
The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Buffer.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/buffer.cpp](#)

7.3 ven::DescriptorPool::Builder Class Reference

```
#include <Pool.hpp>
```

Collaboration diagram for ven::DescriptorPool::Builder:



Public Member Functions

- [Builder](#) ([Device](#) &device)
- `std::unique_ptr< DescriptorPool > build ()` const
- [Builder](#) & [addPoolSize](#) (const `VkDescriptorType` descriptorType, const `uint32_t` count)
- [Builder](#) & [setPoolFlags](#) (const `VkDescriptorPoolCreateFlags` flags)
- [Builder](#) & [setMaxSets](#) (const `uint32_t` count)

Private Attributes

- [Device](#) & [m_device](#)
- `std::vector< VkDescriptorPoolSize >` [m_poolSizes](#)
- `uint32_t` [m_maxSets](#) {`DEFAULT_MAX_SETS`}
- `VkDescriptorPoolCreateFlags` [m_poolFlags](#) {0}

7.3.1 Detailed Description

Definition at line 26 of file [Pool.hpp](#).

7.3.2 Constructor & Destructor Documentation

7.3.2.1 Builder()

```
ven::DescriptorPool::Builder::Builder (  
    Device & device)    [inline], [explicit]
```

Definition at line 30 of file [Pool.hpp](#).

7.3.3 Member Function Documentation

7.3.3.1 addPoolSize()

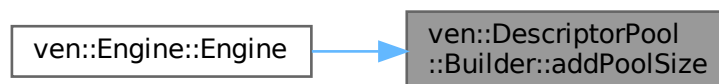
```
Builder & ven::DescriptorPool::Builder::addPoolSize (  
    const VkDescriptorType descriptorType,  
    const uint32_t count)    [inline]
```

Definition at line 34 of file [Pool.hpp](#).

References [m_poolSizes](#).

Referenced by [ven::Engine::Engine\(\)](#).

Here is the caller graph for this function:



7.3.3.2 build()

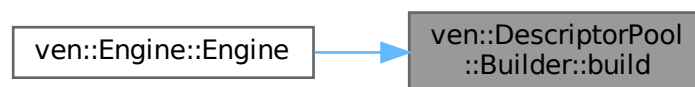
```
std::unique_ptr< DescriptorPool > ven::DescriptorPool::Builder::build () const [inline],  
[nodiscard]
```

Definition at line 32 of file [Pool.hpp](#).

References [m_device](#), [m_maxSets](#), [m_poolFlags](#), and [m_poolSizes](#).

Referenced by [ven::Engine::Engine\(\)](#).

Here is the caller graph for this function:



7.3.3.3 setMaxSets()

```
Builder & ven::DescriptorPool::Builder::setMaxSets (  
    const uint32_t count) [inline]
```

Definition at line 36 of file [Pool.hpp](#).

References [m_maxSets](#).

Referenced by [ven::Engine::Engine\(\)](#).

Here is the caller graph for this function:



7.3.3.4 setPoolFlags()

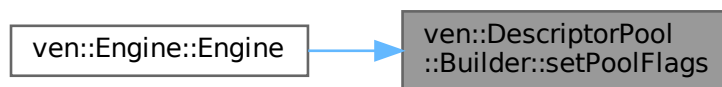
```
Builder & ven::DescriptorPool::Builder::setPoolFlags (
    const VkDescriptorPoolCreateFlags flags) [inline]
```

Definition at line 35 of file [Pool.hpp](#).

References [m_poolFlags](#).

Referenced by [ven::Engine::Engine\(\)](#).

Here is the caller graph for this function:



7.3.4 Member Data Documentation

7.3.4.1 m_device

```
Device& ven::DescriptorPool::Builder::m_device [private]
```

Definition at line 40 of file [Pool.hpp](#).

Referenced by [build\(\)](#).

7.3.4.2 m_maxSets

```
uint32_t ven::DescriptorPool::Builder::m_maxSets {DEFAULT_MAX_SETS} [private]
```

Definition at line 42 of file [Pool.hpp](#).

Referenced by [build\(\)](#), and [setMaxSets\(\)](#).

7.3.4.3 m_poolFlags

```
VkDescriptorPoolCreateFlags ven::DescriptorPool::Builder::m_poolFlags {0} [private]
```

Definition at line 43 of file [Pool.hpp](#).

Referenced by [build\(\)](#), and [setPoolFlags\(\)](#).

7.3.4.4 m_poolSizes

```
std::vector<VkDescriptorPoolSize> ven::DescriptorPool::Builder::m_poolSizes [private]
```

Definition at line 41 of file [Pool.hpp](#).

Referenced by [addPoolSize\(\)](#), and [build\(\)](#).

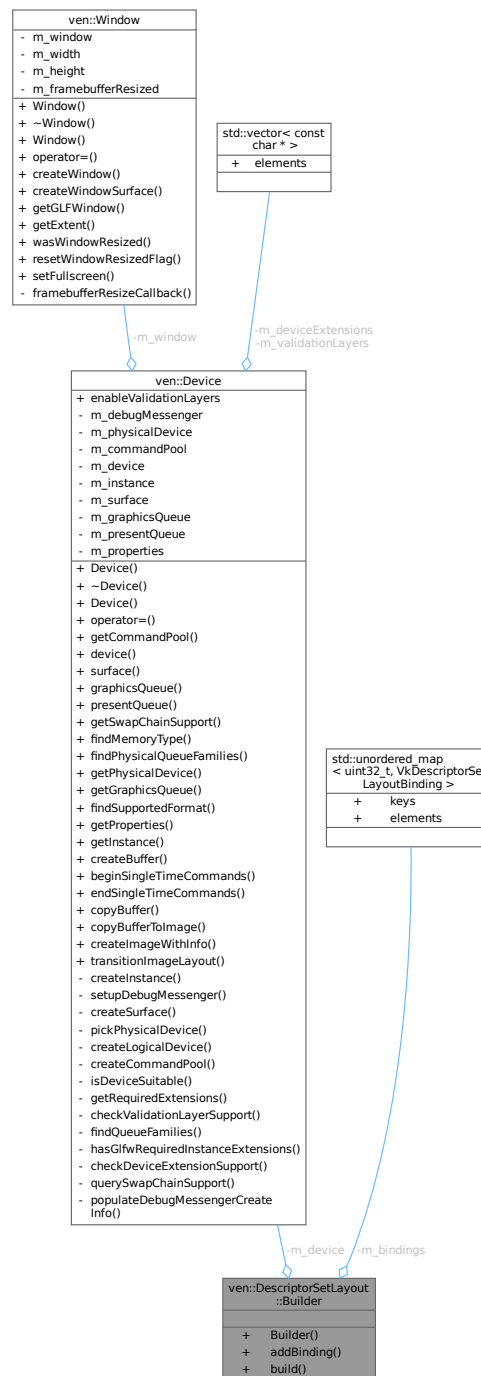
The documentation for this class was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/Pool.hpp](#)

7.4 ven::DescriptorSetLayout::Builder Class Reference

```
#include <SetLayout.hpp>
```

Collaboration diagram for `ven::DescriptorSetLayout::Builder`:



Public Member Functions

- [Builder](#) ([Device](#) &device)
- [Builder](#) & [addBinding](#) (uint32_t binding, VkDescriptorType descriptorType, VkShaderStageFlags stageFlags, uint32_t count=1)
- `std::unique_ptr< DescriptorSetLayout > build ()` const

Private Attributes

- [Device](#) & [m_device](#)
- `std::unordered_map< uint32_t, VkDescriptorSetLayoutBinding >` [m_bindings](#)

7.4.1 Detailed Description

Definition at line 25 of file [SetLayout.hpp](#).

7.4.2 Constructor & Destructor Documentation

7.4.2.1 Builder()

```
ven::DescriptorSetLayout::Builder::Builder (
    Device & device) [inline], [explicit]
```

Definition at line 29 of file [SetLayout.hpp](#).

7.4.3 Member Function Documentation

7.4.3.1 addBinding()

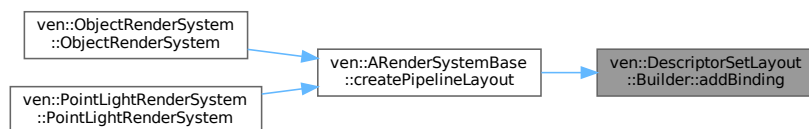
```
ven::DescriptorSetLayout::Builder & ven::DescriptorSetLayout::Builder::addBinding (
    uint32_t binding,
    VkDescriptorType descriptorType,
    VkShaderStageFlags stageFlags,
    uint32_t count = 1)
```

Definition at line 5 of file [setLayout.cpp](#).

References [m_bindings](#).

Referenced by [ven::ARenderSystemBase::createPipelineLayout\(\)](#).

Here is the caller graph for this function:



7.4.3.2 build()

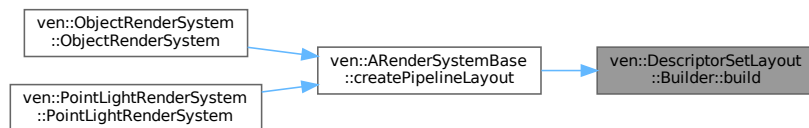
```
std::unique_ptr< DescriptorSetLayout > ven::DescriptorSetLayout::Builder::build () const
[inline]
```

Definition at line 32 of file [SetLayout.hpp](#).

References [m_bindings](#), and [m_device](#).

Referenced by [ven::ARenderSystemBase::createPipelineLayout\(\)](#).

Here is the caller graph for this function:



7.4.4 Member Data Documentation

7.4.4.1 m_bindings

```
std::unordered_map<uint32_t, VkDescriptorSetLayoutBinding> ven::DescriptorSetLayout::Builder↔
::m_bindings [private]
```

Definition at line 37 of file [SetLayout.hpp](#).

Referenced by [addBinding\(\)](#), and [build\(\)](#).

7.4.4.2 m_device

```
Device& ven::DescriptorSetLayout::Builder::m_device [private]
```

Definition at line 36 of file [SetLayout.hpp](#).

Referenced by [build\(\)](#).

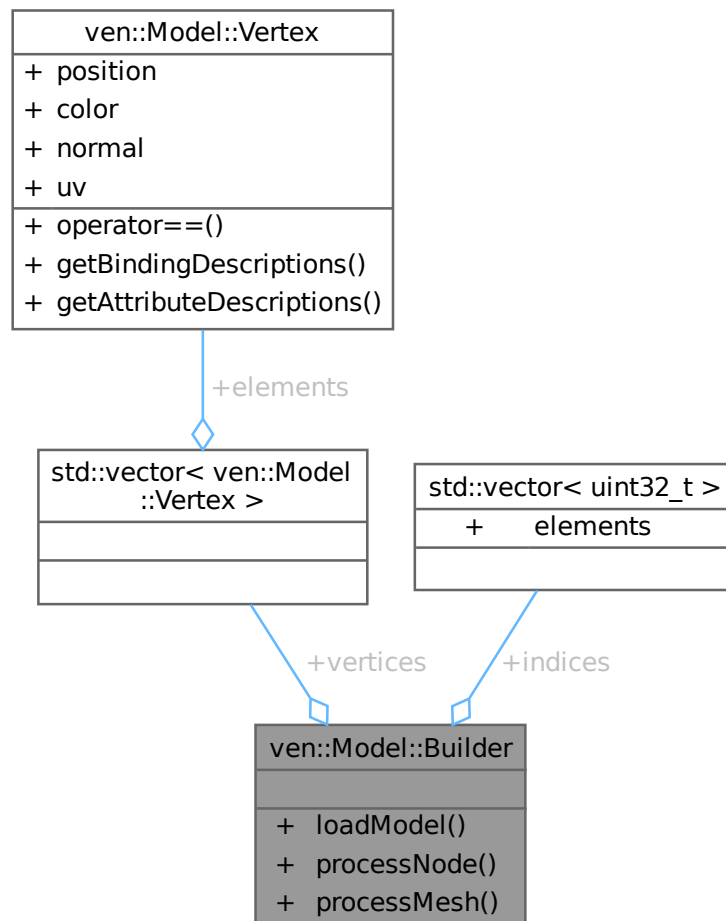
The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/SetLayout.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/Descriptors/setLayout.cpp](#)

7.5 ven::Model::Builder Struct Reference

```
#include <Model.hpp>
```

Collaboration diagram for ven::Model::Builder:



Public Member Functions

- void [loadModel](#) (const std::string &filename)
- void [processNode](#) (const aiNode *node, const aiScene *scene)
- void [processMesh](#) (const aiMesh *mesh, const aiScene *scene)

Public Attributes

- std::vector< [Vertex](#) > [vertices](#)
- std::vector< uint32_t > [indices](#)

7.5.1 Detailed Description

Definition at line 42 of file [Model.hpp](#).

7.5.2 Member Function Documentation

7.5.2.1 loadModel()

```
void ven::Model::Builder::loadModel (
    const std::string & filename)
```

Definition at line 112 of file [model.cpp](#).

Referenced by [ven::Model::createModelFromFile\(\)](#).

Here is the caller graph for this function:



7.5.2.2 processMesh()

```
void ven::Model::Builder::processMesh (
    const aiMesh * mesh,
    const aiScene * scene)
```

Definition at line 138 of file [model.cpp](#).

References [ven::Colors::BLACK_3](#), [ven::Model::Vertex::position](#), and [ven::Colors::WHITE_3](#).

7.5.2.3 processNode()

```
void ven::Model::Builder::processNode (
    const aiNode * node,
    const aiScene * scene)
```

Definition at line 127 of file [model.cpp](#).

7.5.3 Member Data Documentation

7.5.3.1 indices

```
std::vector<uint32_t> ven::Model::Builder::indices
```

Definition at line 44 of file [Model.hpp](#).

Referenced by [ven::Model::Model\(\)](#).

7.5.3.2 vertices

```
std::vector<Vertex> ven::Model::Builder::vertices
```

Definition at line 43 of file [Model.hpp](#).

Referenced by [ven::Model::Model\(\)](#).

The documentation for this struct was generated from the following files:

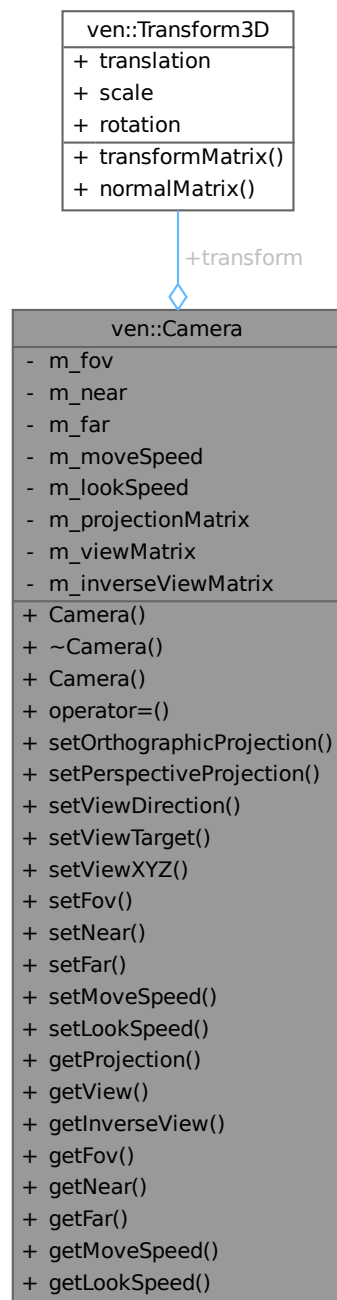
- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Model.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/model.cpp](#)

7.6 ven::Camera Class Reference

Class for camera.

```
#include <Camera.hpp>
```

Collaboration diagram for ven::Camera:



Public Member Functions

- [Camera](#) ()=default
- [~Camera](#) ()=default
- [Camera](#) (const [Camera](#) &)=delete
- [Camera](#) & [operator=](#) (const [Camera](#) &)=delete
- void [setOrthographicProjection](#) (float left, float right, float top, float bottom, float near, float far)

- void [setPerspectiveProjection](#) (float aspect)
- void [setViewDirection](#) (glm::vec3 position, glm::vec3 direction, glm::vec3 up={0.F, -1.F, 0.F})
- void [setViewTarget](#) (const glm::vec3 position, const glm::vec3 target, const glm::vec3 up={0.F, -1.F, 0.F})
- void [setViewXYZ](#) (glm::vec3 position, glm::vec3 rotation)
- void [setFov](#) (const float fov)
- void [setNear](#) (const float near)
- void [setFar](#) (const float far)
- void [setMoveSpeed](#) (const float moveSpeed)
- void [setLookSpeed](#) (const float lookSpeed)
- const glm::mat4 & [getProjection](#) () const
- const glm::mat4 & [getView](#) () const
- const glm::mat4 & [getInverseView](#) () const
- float [getFov](#) () const
- float [getNear](#) () const
- float [getFar](#) () const
- float [getMoveSpeed](#) () const
- float [getLookSpeed](#) () const

Public Attributes

- [Transform3D transform](#) {DEFAULT_POSITION, {1.F, 1.F, 1.F}, DEFAULT_ROTATION}

Private Attributes

- float [m_fov](#) {DEFAULT_FOV}
- float [m_near](#) {DEFAULT_NEAR}
- float [m_far](#) {DEFAULT_FAR}
- float [m_moveSpeed](#) {DEFAULT_MOVE_SPEED}
- float [m_lookSpeed](#) {DEFAULT_LOOK_SPEED}
- glm::mat4 [m_projectionMatrix](#) {1.F}
- glm::mat4 [m_viewMatrix](#) {1.F}
- glm::mat4 [m_inverseViewMatrix](#) {1.F}

7.6.1 Detailed Description

Class for camera.

Definition at line 28 of file [Camera.hpp](#).

7.6.2 Constructor & Destructor Documentation

7.6.2.1 Camera() [1/2]

```
ven::Camera::Camera () [default]
```

7.6.2.2 ~Camera()

```
ven::Camera::~~Camera () [default]
```

7.6.2.3 Camera() [2/2]

```
ven::Camera::Camera (  
    const Camera & ) [delete]
```

7.6.3 Member Function Documentation

7.6.3.1 getFar()

```
float ven::Camera::getFar () const [inline], [nodiscard]
```

Definition at line 54 of file [Camera.hpp](#).

References [m_far](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

Here is the caller graph for this function:



7.6.3.2 getFov()

```
float ven::Camera::getFov () const [inline], [nodiscard]
```

Definition at line 52 of file [Camera.hpp](#).

References [m_fov](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

Here is the caller graph for this function:



7.6.3.3 getInverseView()

```
const glm::mat4 & ven::Camera::getInverseView () const [inline], [nodiscard]
```

Definition at line 51 of file [Camera.hpp](#).

References [m_inverseViewMatrix](#).

7.6.3.4 getLookSpeed()

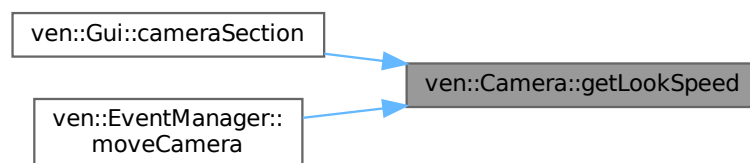
```
float ven::Camera::getLookSpeed () const [inline], [nodiscard]
```

Definition at line 56 of file [Camera.hpp](#).

References [m_lookSpeed](#).

Referenced by [ven::Gui::cameraSection\(\)](#), and [ven::EventManager::moveCamera\(\)](#).

Here is the caller graph for this function:



7.6.3.5 getMoveSpeed()

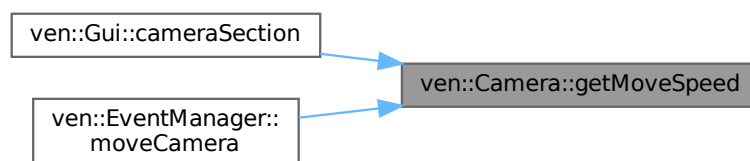
```
float ven::Camera::getMoveSpeed () const [inline], [nodiscard]
```

Definition at line 55 of file [Camera.hpp](#).

References [m_moveSpeed](#).

Referenced by [ven::Gui::cameraSection\(\)](#), and [ven::EventManager::moveCamera\(\)](#).

Here is the caller graph for this function:



7.6.3.6 getNear()

```
float ven::Camera::getNear () const [inline], [nodiscard]
```

Definition at line 53 of file [Camera.hpp](#).

References [m_near](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

Here is the caller graph for this function:



7.6.3.7 getProjection()

```
const glm::mat4 & ven::Camera::getProjection () const [inline], [nodiscard]
```

Definition at line 49 of file [Camera.hpp](#).

References [m_projectionMatrix](#).

7.6.3.8 getView()

```
const glm::mat4 & ven::Camera::getView () const [inline], [nodiscard]
```

Definition at line 50 of file [Camera.hpp](#).

References [m_viewMatrix](#).

7.6.3.9 operator=()

```
Camera & ven::Camera::operator= (  
    const Camera & ) [delete]
```

7.6.3.10 setFar()

```
void ven::Camera::setFar (
    const float far) [inline]
```

Definition at line 45 of file [Camera.hpp](#).

References [m_far](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

Here is the caller graph for this function:



7.6.3.11 setFov()

```
void ven::Camera::setFov (
    const float fov) [inline]
```

Definition at line 43 of file [Camera.hpp](#).

References [m_fov](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

Here is the caller graph for this function:



7.6.3.12 setLookSpeed()

```
void ven::Camera::setLookSpeed (
    const float lookSpeed) [inline]
```

Definition at line 47 of file [Camera.hpp](#).

References [m_lookSpeed](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

Here is the caller graph for this function:



7.6.3.13 setMoveSpeed()

```
void ven::Camera::setMoveSpeed (
    const float moveSpeed) [inline]
```

Definition at line 46 of file [Camera.hpp](#).

References [m_moveSpeed](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

Here is the caller graph for this function:



7.6.3.14 setNear()

```
void ven::Camera::setNear (
    const float near) [inline]
```

Definition at line 44 of file [Camera.hpp](#).

References [m_near](#).

Referenced by [ven::Gui::cameraSection\(\)](#).

Here is the caller graph for this function:



7.6.3.15 setOrthographicProjection()

```
void ven::Camera::setOrthographicProjection (
    float left,
    float right,
    float top,
    float bottom,
    float near,
    float far)
```

Definition at line 6 of file [camera.cpp](#).

References [m_projectionMatrix](#).

7.6.3.16 setPerspectiveProjection()

```
void ven::Camera::setPerspectiveProjection (
    float aspect)
```

Definition at line 17 of file [camera.cpp](#).

7.6.3.17 setViewDirection()

```
void ven::Camera::setViewDirection (
    glm::vec3 position,
    glm::vec3 direction,
    glm::vec3 up = {0.F, -1.F, 0.F})
```

Definition at line 29 of file [camera.cpp](#).

7.6.3.18 `setViewTarget()`

```
void ven::Camera::setViewTarget (
    const glm::vec3 position,
    const glm::vec3 target,
    const glm::vec3 up = {0.F, -1.F, 0.F}) [inline]
```

Definition at line 41 of file [Camera.hpp](#).

7.6.3.19 `setViewXYZ()`

```
void ven::Camera::setViewXYZ (
    glm::vec3 position,
    glm::vec3 rotation)
```

Definition at line 64 of file [camera.cpp](#).

7.6.4 Member Data Documentation

7.6.4.1 `m_far`

```
float ven::Camera::m_far {DEFAULT_FAR} [private]
```

Definition at line 64 of file [Camera.hpp](#).

Referenced by [getFar\(\)](#), and [setFar\(\)](#).

7.6.4.2 `m_fov`

```
float ven::Camera::m_fov {DEFAULT_FOV} [private]
```

Definition at line 62 of file [Camera.hpp](#).

Referenced by [getFov\(\)](#), and [setFov\(\)](#).

7.6.4.3 `m_inverseViewMatrix`

```
glm::mat4 ven::Camera::m_inverseViewMatrix {1.F} [private]
```

Definition at line 69 of file [Camera.hpp](#).

Referenced by [getInverseView\(\)](#).

7.6.4.4 `m_lookSpeed`

```
float ven::Camera::m_lookSpeed {DEFAULT_LOOK_SPEED} [private]
```

Definition at line 66 of file [Camera.hpp](#).

Referenced by [getLookSpeed\(\)](#), and [setLookSpeed\(\)](#).

7.6.4.5 m_moveSpeed

```
float ven::Camera::m_moveSpeed {DEFAULT_MOVE_SPEED} [private]
```

Definition at line 65 of file [Camera.hpp](#).

Referenced by [getMoveSpeed\(\)](#), and [setMoveSpeed\(\)](#).

7.6.4.6 m_near

```
float ven::Camera::m_near {DEFAULT_NEAR} [private]
```

Definition at line 63 of file [Camera.hpp](#).

Referenced by [getNear\(\)](#), and [setNear\(\)](#).

7.6.4.7 m_projectionMatrix

```
glm::mat4 ven::Camera::m_projectionMatrix {1.F} [private]
```

Definition at line 67 of file [Camera.hpp](#).

Referenced by [getProjection\(\)](#), and [setOrthographicProjection\(\)](#).

7.6.4.8 m_viewMatrix

```
glm::mat4 ven::Camera::m_viewMatrix {1.F} [private]
```

Definition at line 68 of file [Camera.hpp](#).

Referenced by [getView\(\)](#).

7.6.4.9 transform

```
Transform3D ven::Camera::transform {DEFAULT_POSITION, {1.F, 1.F, 1.F}, DEFAULT_ROTATION}
```

Definition at line 58 of file [Camera.hpp](#).

Referenced by [ven::Gui::cameraSection\(\)](#), and [ven::EventManager::moveCamera\(\)](#).

The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Scene/Camera.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Scene/camera.cpp](#)

7.7 ven::Clock Class Reference

Class for clock.

```
#include <Clock.hpp>
```

Collaboration diagram for ven::Clock:

ven::Clock
<ul style="list-style-type: none"> - m_startTime - m_stopTime - m_deltaTime - m_isStopped
<ul style="list-style-type: none"> + Clock() + ~Clock() + Clock() + operator=() + start() + stop() + resume() + update() + getDeltaTime() + getDeltaTimeMS() + getFPS()

Public Member Functions

- [Clock](#) ()
- [~Clock](#) ()=default
- [Clock](#) (const [Clock](#) &)=delete
- [Clock](#) & [operator=](#) (const [Clock](#) &)=delete
- void [start](#) ()
- void [stop](#) ()
- void [resume](#) ()
- void [update](#) ()
- float [getDeltaTime](#) () const
- float [getDeltaTimeMS](#) () const
- float [getFPS](#) () const

Private Attributes

- [TimePoint](#) m_startTime
- [TimePoint](#) m_stopTime
- std::chrono::duration< float > [m_deltaTime](#) {0.F}
- bool [m_isStopped](#) {false}

7.7.1 Detailed Description

Class for clock.

Definition at line 20 of file [Clock.hpp](#).

7.7.2 Constructor & Destructor Documentation

7.7.2.1 Clock() [1/2]

```
ven::Clock::Clock () [inline]
```

Definition at line 24 of file [Clock.hpp](#).

References [start\(\)](#).

Here is the call graph for this function:



7.7.2.2 ~Clock()

```
ven::Clock::~~Clock () [default]
```

7.7.2.3 Clock() [2/2]

```
ven::Clock::Clock (
    const Clock & ) [delete]
```

7.7.3 Member Function Documentation

7.7.3.1 getDeltaTime()

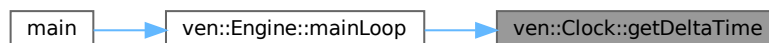
```
float ven::Clock::getDeltaTime () const [inline], [nodiscard]
```

Definition at line 35 of file [Clock.hpp](#).

References [m_deltaTime](#).

Referenced by [ven::Engine::mainLoop\(\)](#).

Here is the caller graph for this function:



7.7.3.2 getDeltaTimeMS()

```
float ven::Clock::getDeltaTimeMS () const [inline], [nodiscard]
```

Definition at line 36 of file [Clock.hpp](#).

References [m_deltaTime](#).

7.7.3.3 getFPS()

```
float ven::Clock::getFPS () const [inline], [nodiscard]
```

Definition at line 37 of file [Clock.hpp](#).

References [m_deltaTime](#).

7.7.3.4 operator=()

```
Clock & ven::Clock::operator= (  
    const Clock & ) [delete]
```

7.7.3.5 resume()

```
void ven::Clock::resume ()
```

Definition at line 20 of file [clock.cpp](#).

7.7.3.6 start()

```
void ven::Clock::start () [inline]
```

Definition at line 30 of file [Clock.hpp](#).

References [m_startTime](#).

Referenced by [Clock\(\)](#).

Here is the caller graph for this function:



7.7.3.7 stop()

```
void ven::Clock::stop ()
```

Definition at line 10 of file [clock.cpp](#).

7.7.3.8 update()

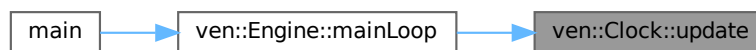
```
void ven::Clock::update ()
```

Definition at line 3 of file [clock.cpp](#).

References [m_deltaTime](#), and [m_startTime](#).

Referenced by [ven::Engine::mainLoop\(\)](#).

Here is the caller graph for this function:



7.7.4 Member Data Documentation

7.7.4.1 m_deltaTime

```
std::chrono::duration<float> ven::Clock::m_deltaTime {0.F} [private]
```

Definition at line 43 of file [Clock.hpp](#).

Referenced by [getDeltaTime\(\)](#), [getDeltaTimeMS\(\)](#), [getFPS\(\)](#), and [update\(\)](#).

7.7.4.2 m_isStopped

```
bool ven::Clock::m_isStopped {false} [private]
```

Definition at line 45 of file [Clock.hpp](#).

7.7.4.3 m_startTime

```
TimePoint ven::Clock::m_startTime [private]
```

Definition at line 41 of file [Clock.hpp](#).

Referenced by [start\(\)](#), and [update\(\)](#).

7.7.4.4 m_stopTime

`TimePoint ven::Clock::m_stopTime [private]`

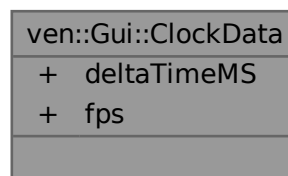
Definition at line 42 of file [Clock.hpp](#).

The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Utils/Clock.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Utils/clock.cpp](#)

7.8 ven::Gui::ClockData Struct Reference

Collaboration diagram for `ven::Gui::ClockData`:



Public Attributes

- float [deltaTimeMS](#) {0.0F}
- float [fps](#) {0.0F}

7.8.1 Detailed Description

Definition at line 32 of file [Gui.hpp](#).

7.8.2 Member Data Documentation

7.8.2.1 deltaTimeMS

`float ven::Gui::ClockData::deltaTimeMS {0.0F}`

Definition at line 33 of file [Gui.hpp](#).

Referenced by [ven::Gui::renderFrameWindow\(\)](#).

7.8.2.2 fps

```
float ven::Gui::ClockData::fps {0.0F}
```

Definition at line 34 of file [Gui.hpp](#).

Referenced by [ven::Gui::renderFrameWindow\(\)](#).

The documentation for this struct was generated from the following file:

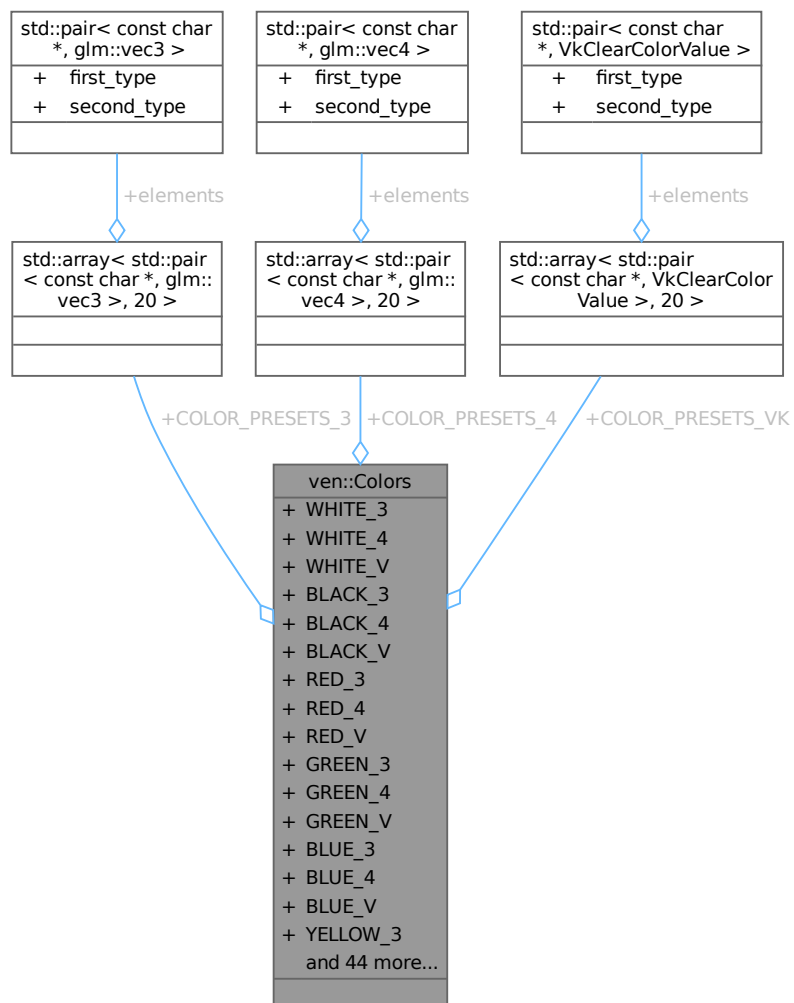
- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/Gui.hpp](#)

7.9 ven::Colors Class Reference

Class for colors.

```
#include <Colors.hpp>
```

Collaboration diagram for ven::Colors:



Static Public Attributes

- static constexpr glm::vec3 [WHITE_3](#) = glm::vec3([COLOR_MAX](#)) / [COLOR_MAX](#)
- static constexpr glm::vec4 [WHITE_4](#) = { 1.0F, 1.0F, 1.0F, 1.0F }
- static constexpr VkClearColorValue [WHITE_V](#) = { { 1.0F, 1.0F, 1.0F, 1.0F } }
- static constexpr glm::vec3 [BLACK_3](#) = glm::vec3(0.0F)
- static constexpr glm::vec4 [BLACK_4](#) = { 0.0F, 0.0F, 0.0F, 1.0F }
- static constexpr VkClearColorValue [BLACK_V](#) = { { 0.0F, 0.0F, 0.0F, 1.0F } }
- static constexpr glm::vec3 [RED_3](#) = glm::vec3([COLOR_MAX](#), 0.0F, 0.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [RED_4](#) = { 1.0F, 0.0F, 0.0F, 1.0F }
- static constexpr VkClearColorValue [RED_V](#) = { { 1.0F, 0.0F, 0.0F, 1.0F } }
- static constexpr glm::vec3 [GREEN_3](#) = glm::vec3(0.0F, [COLOR_MAX](#), 0.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [GREEN_4](#) = { 0.0F, 1.0F, 0.0F, 1.0F }
- static constexpr VkClearColorValue [GREEN_V](#) = { { 0.0F, 1.0F, 0.0F, 1.0F } }
- static constexpr glm::vec3 [BLUE_3](#) = glm::vec3(0.0F, 0.0F, [COLOR_MAX](#)) / [COLOR_MAX](#)
- static constexpr glm::vec4 [BLUE_4](#) = { 0.0F, 0.0F, 1.0F, 1.0F }
- static constexpr VkClearColorValue [BLUE_V](#) = { { 0.0F, 0.0F, 1.0F, 1.0F } }
- static constexpr glm::vec3 [YELLOW_3](#) = glm::vec3([COLOR_MAX](#), [COLOR_MAX](#), 0.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [YELLOW_4](#) = { 1.0F, 1.0F, 0.0F, 1.0F }
- static constexpr VkClearColorValue [YELLOW_V](#) = { { 1.0F, 1.0F, 0.0F, 1.0F } }
- static constexpr glm::vec3 [CYAN_3](#) = glm::vec3(0.0F, [COLOR_MAX](#), [COLOR_MAX](#)) / [COLOR_MAX](#)
- static constexpr glm::vec4 [CYAN_4](#) = { 0.0F, 1.0F, 1.0F, 1.0F }
- static constexpr VkClearColorValue [CYAN_V](#) = { { 0.0F, 1.0F, 1.0F, 1.0F } }
- static constexpr glm::vec3 [MAGENTA_3](#) = glm::vec3([COLOR_MAX](#), 0.0F, [COLOR_MAX](#)) / [COLOR_MAX](#)
- static constexpr glm::vec4 [MAGENTA_4](#) = { 1.0F, 0.0F, 1.0F, 1.0F }
- static constexpr VkClearColorValue [MAGENTA_V](#) = { { 1.0F, 0.0F, 1.0F, 1.0F } }
- static constexpr glm::vec3 [SILVER_3](#) = glm::vec3(192.0F, 192.0F, 192.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [SILVER_4](#) = { 0.75F, 0.75F, 0.75F, 1.0F }
- static constexpr VkClearColorValue [SILVER_V](#) = { { 0.75F, 0.75F, 0.75F, 1.0F } }
- static constexpr glm::vec3 [GRAY_3](#) = glm::vec3(128.0F, 128.0F, 128.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [GRAY_4](#) = { 0.5F, 0.5F, 0.5F, 1.0F }
- static constexpr VkClearColorValue [GRAY_V](#) = { { 0.5F, 0.5F, 0.5F, 1.0F } }
- static constexpr glm::vec3 [MAROON_3](#) = glm::vec3(128.0F, 0.0F, 0.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [MAROON_4](#) = { 0.5F, 0.0F, 0.0F, 1.0F }
- static constexpr VkClearColorValue [MAROON_V](#) = { { 0.5F, 0.0F, 0.0F, 1.0F } }
- static constexpr glm::vec3 [OLIVE_3](#) = glm::vec3(128.0F, 128.0F, 0.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [OLIVE_4](#) = { 0.5F, 0.5F, 0.0F, 1.0F }
- static constexpr VkClearColorValue [OLIVE_V](#) = { { 0.5F, 0.5F, 0.0F, 1.0F } }
- static constexpr glm::vec3 [LIME_3](#) = glm::vec3(0.0F, [COLOR_MAX](#), 0.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [LIME_4](#) = { 0.0F, 1.0F, 0.0F, 1.0F }
- static constexpr VkClearColorValue [LIME_V](#) = { { 0.0F, 1.0F, 0.0F, 1.0F } }
- static constexpr glm::vec3 [AQUA_3](#) = glm::vec3(0.0F, [COLOR_MAX](#), [COLOR_MAX](#)) / [COLOR_MAX](#)
- static constexpr glm::vec4 [AQUA_4](#) = { 0.0F, 1.0F, 1.0F, 1.0F }
- static constexpr VkClearColorValue [AQUA_V](#) = { { 0.0F, 1.0F, 1.0F, 1.0F } }
- static constexpr glm::vec3 [TEAL_3](#) = glm::vec3(0.0F, 128.0F, 128.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [TEAL_4](#) = { 0.0F, 0.5F, 0.5F, 1.0F }
- static constexpr VkClearColorValue [TEAL_V](#) = { { 0.0F, 0.5F, 0.5F, 1.0F } }
- static constexpr glm::vec3 [NAVY_3](#) = glm::vec3(0.0F, 0.0F, 128.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [NAVY_4](#) = { 0.0F, 0.0F, 0.5F, 1.0F }
- static constexpr VkClearColorValue [NAVY_V](#) = { { 0.0F, 0.0F, 0.5F, 1.0F } }
- static constexpr glm::vec3 [FUCHSIA_3](#) = glm::vec3([COLOR_MAX](#), 0.0F, [COLOR_MAX](#)) / [COLOR_MAX](#)
- static constexpr glm::vec4 [FUCHSIA_4](#) = { 1.0F, 0.0F, 1.0F, 1.0F }
- static constexpr VkClearColorValue [FUCHSIA_V](#) = { { 1.0F, 0.0F, 1.0F, 1.0F } }
- static constexpr glm::vec3 [NIGHT_BLUE_3](#) = glm::vec3(25.0F, 25.0F, 112.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [NIGHT_BLUE_4](#) = { 0.098F, 0.098F, 0.439F, 1.0F }

- static constexpr VkClearColorValue [NIGHT_BLUE_V](#) = { { 0.098F, 0.098F, 0.439F, 1.0F } }
- static constexpr glm::vec3 [SKY_BLUE_3](#) = glm::vec3(102.0F, 178.0F, 255.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [SKY_BLUE_4](#) = { 0.4F, 0.698F, 1.0F, 1.0F }
- static constexpr VkClearColorValue [SKY_BLUE_V](#) = { { 0.4F, 0.698F, 1.0F, 1.0F } }
- static constexpr glm::vec3 [SUNSET_3](#) = glm::vec3(255.0F, 128.0F, 0.0F) / [COLOR_MAX](#)
- static constexpr glm::vec4 [SUNSET_4](#) = { 1.0F, 0.5F, 0.0F, 1.0F }
- static constexpr VkClearColorValue [SUNSET_V](#) = { { 1.0F, 0.5F, 0.0F, 1.0F } }
- static constexpr std::array< std::pair< const char *, glm::vec3 >, 20 > [COLOR_PRESETS_3](#)
- static constexpr std::array< std::pair< const char *, glm::vec4 >, 20 > [COLOR_PRESETS_4](#)
- static constexpr std::array< std::pair< const char *, VkClearColorValue >, 20 > [COLOR_PRESETS_VK](#)

7.9.1 Detailed Description

Class for colors.

Definition at line 22 of file [Colors.hpp](#).

7.9.2 Member Data Documentation

7.9.2.1 AQUA_3

```
glm::vec3 ven::Colors::AQUA_3 = glm::vec3(0.0F, COLOR\_MAX, COLOR\_MAX) / COLOR\_MAX [static],
[constexpr]
```

Definition at line 78 of file [Colors.hpp](#).

7.9.2.2 AQUA_4

```
glm::vec4 ven::Colors::AQUA_4 = { 0.0F, 1.0F, 1.0F, 1.0F } [static], [constexpr]
```

Definition at line 79 of file [Colors.hpp](#).

7.9.2.3 AQUA_V

```
VkClearColorValue ven::Colors::AQUA_V = { { 0.0F, 1.0F, 1.0F, 1.0F } } [static], [constexpr]
```

Definition at line 80 of file [Colors.hpp](#).

7.9.2.4 BLACK_3

```
glm::vec3 ven::Colors::BLACK_3 = glm::vec3(0.0F) [static], [constexpr]
```

Definition at line 30 of file [Colors.hpp](#).

Referenced by [ven::Model::Builder::processMesh\(\)](#).

7.9.2.5 BLACK_4

```
glm::vec4 ven::Colors::BLACK_4 = { 0.0F, 0.0F, 0.0F, 1.0F } [static], [constexpr]
```

Definition at line 31 of file [Colors.hpp](#).

7.9.2.6 BLACK_V

```
VkClearColorValue ven::Colors::BLACK_V = { { 0.0F, 0.0F, 0.0F, 1.0F } } [static], [constexpr]
```

Definition at line 32 of file [Colors.hpp](#).

7.9.2.7 BLUE_3

```
glm::vec3 ven::Colors::BLUE_3 = glm::vec3(0.0F, 0.0F, COLOR_MAX) / COLOR_MAX [static], [constexpr]
```

Definition at line 42 of file [Colors.hpp](#).

7.9.2.8 BLUE_4

```
glm::vec4 ven::Colors::BLUE_4 = { 0.0F, 0.0F, 1.0F, 1.0F } [static], [constexpr]
```

Definition at line 43 of file [Colors.hpp](#).

Referenced by [ven::Engine::loadObjects\(\)](#).

7.9.2.9 BLUE_V

```
VkClearColorValue ven::Colors::BLUE_V = { { 0.0F, 0.0F, 1.0F, 1.0F } } [static], [constexpr]
```

Definition at line 44 of file [Colors.hpp](#).

7.9.2.10 COLOR_PRESETS_3

```
std::array<std::pair<const char *, glm::vec3>, 20> ven::Colors::COLOR_PRESETS_3 [static], [constexpr]
```

Initial value:

```
= {{
    {"White", WHITE_3},
    {"Black", BLACK_3},
    {"Red", RED_3},
    {"Green", GREEN_3},
    {"Blue", BLUE_3},
    {"Yellow", YELLOW_3},
    {"Cyan", CYAN_3},
    {"Magenta", MAGENTA_3},
    {"Silver", SILVER_3},
    {"Gray", GRAY_3},
    {"Maroon", MAROON_3},
    {"Olive", OLIVE_3},
    {"Lime", LIME_3},
    {"Aqua", AQUA_3},
    {"Teal", TEAL_3},
    {"Navy", NAVY_3},
    {"Fuchsia", FUCHSIA_3},
    {"Night Blue", NIGHT_BLUE_3},
    {"Sky Blue", SKY_BLUE_3},
    {"Sunset", SUNSET_3}
}}
```

Definition at line 107 of file [Colors.hpp](#).

Referenced by [ven::Gui::lightsSection\(\)](#).

7.9.2.11 COLOR_PRESETS_4

```
std::array<std::pair<const char *, glm::vec4>, 20> ven::Colors::COLOR_PRESETS_4 [static],
[constexpr]
```

Initial value:

```
= {{
    {"White", WHITE_4},
    {"Black", BLACK_4},
    {"Red", RED_4},
    {"Green", GREEN_4},
    {"Blue", BLUE_4},
    {"Yellow", YELLOW_4},
    {"Cyan", CYAN_4},
    {"Magenta", MAGENTA_4},
    {"Silver", SILVER_4},
    {"Gray", GRAY_4},
    {"Maroon", MAROON_4},
    {"Olive", OLIVE_4},
    {"Lime", LIME_4},
    {"Aqua", AQUA_4},
    {"Teal", TEAL_4},
    {"Navy", NAVY_4},
    {"Fuchsia", FUCHSIA_4},
    {"Night Blue", NIGHT_BLUE_4},
    {"Sky Blue", SKY_BLUE_4},
    {"Sunset", SUNSET_4}
}}
```

Definition at line 130 of file [Colors.hpp](#).

Referenced by [ven::Gui::rendererSection\(\)](#).

7.9.2.12 COLOR_PRESETS_VK

```
std::array<std::pair<const char *, VkClearColorValue>, 20> ven::Colors::COLOR_PRESETS_VK
[static], [constexpr]
```

Initial value:

```
= {{
    {"White", WHITE_V},
    {"Black", BLACK_V},
    {"Red", RED_V},
    {"Green", GREEN_V},
    {"Blue", BLUE_V},
    {"Yellow", YELLOW_V},
    {"Cyan", CYAN_V},
    {"Magenta", MAGENTA_V},
    {"Silver", SILVER_V},
    {"Gray", GRAY_V},
    {"Maroon", MAROON_V},
    {"Olive", OLIVE_V},
    {"Lime", LIME_V},
    {"Aqua", AQUA_V},
    {"Teal", TEAL_V},
    {"Navy", NAVY_V},
    {"Fuchsia", FUCHSIA_V},
    {"Night Blue", NIGHT_BLUE_V},
    {"Sky Blue", SKY_BLUE_V},
    {"Sunset", SUNSET_V}
}}
```

Definition at line 153 of file [Colors.hpp](#).

Referenced by [ven::Gui::rendererSection\(\)](#).

7.9.2.13 CYAN_3

```
glm::vec3 ven::Colors::CYAN_3 = glm::vec3(0.0F, COLOR_MAX, COLOR_MAX) / COLOR_MAX [static],
[constexpr]
```

Definition at line 50 of file [Colors.hpp](#).

7.9.2.14 CYAN_4

```
glm::vec4 ven::Colors::CYAN_4 = { 0.0F, 1.0F, 1.0F, 1.0F } [static], [constexpr]
```

Definition at line 51 of file [Colors.hpp](#).

Referenced by [ven::Engine::loadObjects\(\)](#).

7.9.2.15 CYAN_V

```
VkClearColorValue ven::Colors::CYAN_V = { { 0.0F, 1.0F, 1.0F, 1.0F } } [static], [constexpr]
```

Definition at line 52 of file [Colors.hpp](#).

7.9.2.16 FUCHSIA_3

```
glm::vec3 ven::Colors::FUCHSIA_3 = glm::vec3(COLOR_MAX, 0.0F, COLOR_MAX) / COLOR_MAX [static],  
[constexpr]
```

Definition at line 90 of file [Colors.hpp](#).

7.9.2.17 FUCHSIA_4

```
glm::vec4 ven::Colors::FUCHSIA_4 = { 1.0F, 0.0F, 1.0F, 1.0F } [static], [constexpr]
```

Definition at line 91 of file [Colors.hpp](#).

7.9.2.18 FUCHSIA_V

```
VkClearColorValue ven::Colors::FUCHSIA_V = { { 1.0F, 0.0F, 1.0F, 1.0F } } [static], [constexpr]
```

Definition at line 92 of file [Colors.hpp](#).

7.9.2.19 GRAY_3

```
glm::vec3 ven::Colors::GRAY_3 = glm::vec3(128.0F, 128.0F, 128.0F) / COLOR_MAX [static], [constexpr]
```

Definition at line 62 of file [Colors.hpp](#).

7.9.2.20 GRAY_4

```
glm::vec4 ven::Colors::GRAY_4 = { 0.5F, 0.5F, 0.5F, 1.0F } [static], [constexpr]
```

Definition at line 63 of file [Colors.hpp](#).

Referenced by [ven::Gui::objectsSection\(\)](#).

7.9.2.21 GRAY_V

```
VkClearColorValue ven::Colors::GRAY_V = { { 0.5F, 0.5F, 0.5F, 1.0F } } [static], [constexpr]
```

Definition at line 64 of file [Colors.hpp](#).

7.9.2.22 GREEN_3

```
glm::vec3 ven::Colors::GREEN_3 = glm::vec3(0.0F, COLOR_MAX, 0.0F) / COLOR_MAX [static], [constexpr]
```

Definition at line 38 of file [Colors.hpp](#).

7.9.2.23 GREEN_4

```
glm::vec4 ven::Colors::GREEN_4 = { 0.0F, 1.0F, 0.0F, 1.0F } [static], [constexpr]
```

Definition at line 39 of file [Colors.hpp](#).

Referenced by [ven::Engine::loadObjects\(\)](#).

7.9.2.24 GREEN_V

```
VkClearColorValue ven::Colors::GREEN_V = { { 0.0F, 1.0F, 0.0F, 1.0F } } [static], [constexpr]
```

Definition at line 40 of file [Colors.hpp](#).

7.9.2.25 LIME_3

```
glm::vec3 ven::Colors::LIME_3 = glm::vec3(0.0F, COLOR_MAX, 0.0F) / COLOR_MAX [static], [constexpr]
```

Definition at line 74 of file [Colors.hpp](#).

7.9.2.26 LIME_4

```
glm::vec4 ven::Colors::LIME_4 = { 0.0F, 1.0F, 0.0F, 1.0F } [static], [constexpr]
```

Definition at line 75 of file [Colors.hpp](#).

7.9.2.27 LIME_V

```
VkClearColorValue ven::Colors::LIME_V = { { 0.0F, 1.0F, 0.0F, 1.0F } } [static], [constexpr]
```

Definition at line 76 of file [Colors.hpp](#).

7.9.2.28 MAGENTA_3

```
glm::vec3 ven::Colors::MAGENTA_3 = glm::vec3(COLOR_MAX, 0.0F, COLOR_MAX) / COLOR_MAX [static],  
[constexpr]
```

Definition at line 54 of file [Colors.hpp](#).

7.9.2.29 MAGENTA_4

```
glm::vec4 ven::Colors::MAGENTA_4 = { 1.0F, 0.0F, 1.0F, 1.0F } [static], [constexpr]
```

Definition at line 55 of file [Colors.hpp](#).

Referenced by [ven::Engine::loadObjects\(\)](#).

7.9.2.30 MAGENTA_V

```
VkClearColorValue ven::Colors::MAGENTA_V = { { 1.0F, 0.0F, 1.0F, 1.0F } } [static], [constexpr]
```

Definition at line 56 of file [Colors.hpp](#).

7.9.2.31 MAROON_3

```
glm::vec3 ven::Colors::MAROON_3 = glm::vec3(128.0F, 0.0F, 0.0F) / COLOR_MAX [static], [constexpr]
```

Definition at line 66 of file [Colors.hpp](#).

7.9.2.32 MAROON_4

```
glm::vec4 ven::Colors::MAROON_4 = { 0.5F, 0.0F, 0.0F, 1.0F } [static], [constexpr]
```

Definition at line 67 of file [Colors.hpp](#).

7.9.2.33 MAROON_V

```
VkClearColorValue ven::Colors::MAROON_V = { { 0.5F, 0.0F, 0.0F, 1.0F } } [static], [constexpr]
```

Definition at line 68 of file [Colors.hpp](#).

7.9.2.34 NAVY_3

```
glm::vec3 ven::Colors::NAVY_3 = glm::vec3(0.0F, 0.0F, 128.0F) / COLOR_MAX [static], [constexpr]
```

Definition at line 86 of file [Colors.hpp](#).

7.9.2.35 NAVY_4

```
glm::vec4 ven::Colors::NAVY_4 = { 0.0F, 0.0F, 0.5F, 1.0F } [static], [constexpr]
```

Definition at line 87 of file [Colors.hpp](#).

7.9.2.36 NAVY_V

```
VkClearColorValue ven::Colors::NAVY_V = { { 0.0F, 0.0F, 0.5F, 1.0F } } [static], [constexpr]
```

Definition at line 88 of file [Colors.hpp](#).

7.9.2.37 NIGHT_BLUE_3

```
glm::vec3 ven::Colors::NIGHT_BLUE_3 = glm::vec3(25.0F, 25.0F, 112.0F) / COLOR_MAX [static],  
[constexpr]
```

Definition at line 94 of file [Colors.hpp](#).

7.9.2.38 NIGHT_BLUE_4

```
glm::vec4 ven::Colors::NIGHT_BLUE_4 = { 0.098F, 0.098F, 0.439F, 1.0F } [static], [constexpr]
```

Definition at line 95 of file [Colors.hpp](#).

7.9.2.39 NIGHT_BLUE_V

```
VkClearColorValue ven::Colors::NIGHT_BLUE_V = { { 0.098F, 0.098F, 0.439F, 1.0F } } [static],  
[constexpr]
```

Definition at line 96 of file [Colors.hpp](#).

7.9.2.40 OLIVE_3

```
glm::vec3 ven::Colors::OLIVE_3 = glm::vec3(128.0F, 128.0F, 0.0F) / COLOR_MAX [static], [constexpr]
```

Definition at line 70 of file [Colors.hpp](#).

7.9.2.41 OLIVE_4

```
glm::vec4 ven::Colors::OLIVE_4 = { 0.5F, 0.5F, 0.0F, 1.0F } [static], [constexpr]
```

Definition at line 71 of file [Colors.hpp](#).

7.9.2.42 OLIVE_V

```
VkClearColorValue ven::Colors::OLIVE_V = { { 0.5F, 0.5F, 0.0F, 1.0F } } [static], [constexpr]
```

Definition at line 72 of file [Colors.hpp](#).

7.9.2.43 RED_3

```
glm::vec3 ven::Colors::RED_3 = glm::vec3(COLOR_MAX, 0.0F, 0.0F) / COLOR_MAX [static], [constexpr]
```

Definition at line 34 of file [Colors.hpp](#).

7.9.2.44 RED_4

```
glm::vec4 ven::Colors::RED_4 = { 1.0F, 0.0F, 0.0F, 1.0F } [static], [constexpr]
```

Definition at line 35 of file [Colors.hpp](#).

Referenced by [ven::Engine::loadObjects\(\)](#).

7.9.2.45 RED_V

```
VkClearColorValue ven::Colors::RED_V = { { 1.0F, 0.0F, 0.0F, 1.0F } } [static], [constexpr]
```

Definition at line 36 of file [Colors.hpp](#).

7.9.2.46 SILVER_3

```
glm::vec3 ven::Colors::SILVER_3 = glm::vec3(192.0F, 192.0F, 192.0F) / COLOR_MAX [static],  
[constexpr]
```

Definition at line 58 of file [Colors.hpp](#).

7.9.2.47 SILVER_4

```
glm::vec4 ven::Colors::SILVER_4 = { 0.75F, 0.75F, 0.75F, 1.0F } [static], [constexpr]
```

Definition at line 59 of file [Colors.hpp](#).

7.9.2.48 SILVER_V

```
VkClearColorValue ven::Colors::SILVER_V = { { 0.75F, 0.75F, 0.75F, 1.0F } } [static], [constexpr]
```

Definition at line 60 of file [Colors.hpp](#).

7.9.2.49 SKY_BLUE_3

```
glm::vec3 ven::Colors::SKY_BLUE_3 = glm::vec3(102.0F, 178.0F, 255.0F) / COLOR_MAX [static],  
[constexpr]
```

Definition at line 98 of file [Colors.hpp](#).

7.9.2.50 SKY_BLUE_4

```
glm::vec4 ven::Colors::SKY_BLUE_4 = { 0.4F, 0.698F, 1.0F, 1.0F } [static], [constexpr]
```

Definition at line 99 of file [Colors.hpp](#).

7.9.2.51 SKY_BLUE_V

```
VkClearColorValue ven::Colors::SKY_BLUE_V = { { 0.4F, 0.698F, 1.0F, 1.0F } } [static], [constexpr]
```

Definition at line 100 of file [Colors.hpp](#).

7.9.2.52 SUNSET_3

```
glm::vec3 ven::Colors::SUNSET_3 = glm::vec3(255.0F, 128.0F, 0.0F) / COLOR_MAX [static], [constexpr]
```

Definition at line 102 of file [Colors.hpp](#).

7.9.2.53 SUNSET_4

```
glm::vec4 ven::Colors::SUNSET_4 = { 1.0F, 0.5F, 0.0F, 1.0F } [static], [constexpr]
```

Definition at line 103 of file [Colors.hpp](#).

7.9.2.54 SUNSET_V

```
VkClearColorValue ven::Colors::SUNSET_V = { { 1.0F, 0.5F, 0.0F, 1.0F } } [static], [constexpr]
```

Definition at line 104 of file [Colors.hpp](#).

7.9.2.55 TEAL_3

```
glm::vec3 ven::Colors::TEAL_3 = glm::vec3(0.0F, 128.0F, 128.0F) / COLOR_MAX [static], [constexpr]
```

Definition at line 82 of file [Colors.hpp](#).

7.9.2.56 TEAL_4

```
glm::vec4 ven::Colors::TEAL_4 = { 0.0F, 0.5F, 0.5F, 1.0F } [static], [constexpr]
```

Definition at line 83 of file [Colors.hpp](#).

7.9.2.57 TEAL_V

```
VkClearColorValue ven::Colors::TEAL_V = { { 0.0F, 0.5F, 0.5F, 1.0F } } [static], [constexpr]
```

Definition at line 84 of file [Colors.hpp](#).

7.9.2.58 WHITE_3

```
glm::vec3 ven::Colors::WHITE_3 = glm::vec3(COLOR_MAX) / COLOR_MAX [static], [constexpr]
```

Definition at line 26 of file [Colors.hpp](#).

Referenced by [ven::Model::Builder::processMesh\(\)](#).

7.9.2.59 WHITE_4

```
glm::vec4 ven::Colors::WHITE_4 = { 1.0F, 1.0F, 1.0F, 1.0F } [static], [constexpr]
```

Definition at line 27 of file [Colors.hpp](#).

7.9.2.60 WHITE_V

```
VkClearColorValue ven::Colors::WHITE_V = { { 1.0F, 1.0F, 1.0F, 1.0F } } [static], [constexpr]
```

Definition at line 28 of file [Colors.hpp](#).

7.9.2.61 YELLOW_3

```
glm::vec3 ven::Colors::YELLOW_3 = glm::vec3(COLOR_MAX, COLOR_MAX, 0.0F) / COLOR_MAX [static],  
[constexpr]
```

Definition at line 46 of file [Colors.hpp](#).

7.9.2.62 YELLOW_4

```
glm::vec4 ven::Colors::YELLOW_4 = { 1.0F, 1.0F, 0.0F, 1.0F } [static], [constexpr]
```

Definition at line 47 of file [Colors.hpp](#).

Referenced by [ven::Engine::loadObjects\(\)](#).

7.9.2.63 YELLOW_V

```
VkClearColorValue ven::Colors::YELLOW_V = { { 1.0F, 1.0F, 0.0F, 1.0F } } [static], [constexpr]
```

Definition at line 48 of file [Colors.hpp](#).

The documentation for this class was generated from the following file:

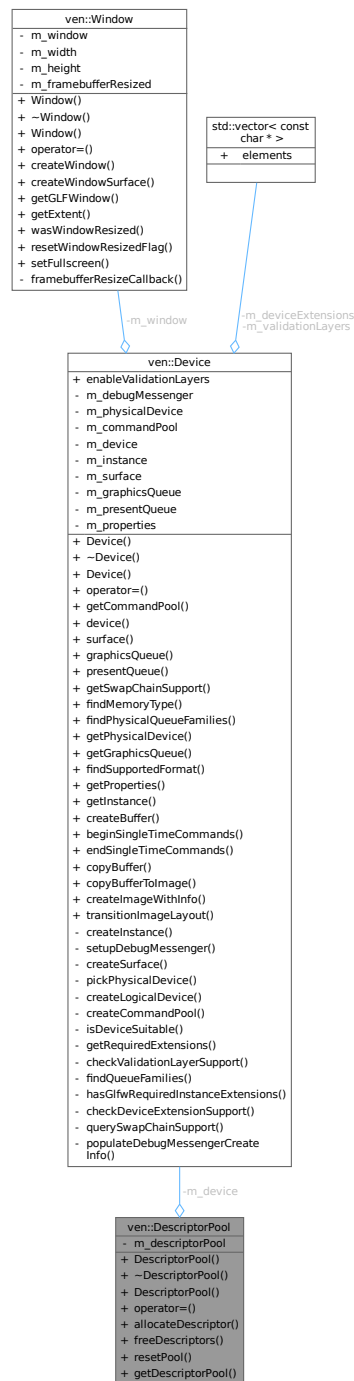
- [/home/runner/work/VEngine/VEngine/include/VEngine/Utils/Colors.hpp](#)

7.10 ven::DescriptorPool Class Reference

Class for descriptor pool.

```
#include <Pool.hpp>
```

Collaboration diagram for `ven::DescriptorPool`:



Classes

- class [Builder](#)

Public Member Functions

- [DescriptorPool](#) ([Device](#) &device, uint32_t maxSets, VkDescriptorPoolCreateFlags poolFlags, const std::vector< VkDescriptorPoolSize > &poolSizes)

- [~DescriptorPool](#) ()
- [DescriptorPool](#) (const [DescriptorPool](#) &)=delete
- [DescriptorPool](#) & [operator=](#) (const [DescriptorPool](#) &)=delete
- bool [allocateDescriptor](#) (VkDescriptorSetLayout descriptorSetLayout, VkDescriptorSet &descriptor) const
- void [freeDescriptors](#) (const std::vector< VkDescriptorSet > &descriptors) const
- void [resetPool](#) () const
- VkDescriptorPool [getDescriptorPool](#) () const

Private Attributes

- [Device](#) & [m_device](#)
- VkDescriptorPool [m_descriptorPool](#)

Friends

- class [DescriptorWriter](#)

7.10.1 Detailed Description

Class for descriptor pool.

Definition at line 22 of file [Pool.hpp](#).

7.10.2 Constructor & Destructor Documentation

7.10.2.1 DescriptorPool() [1/2]

```
ven::DescriptorPool::DescriptorPool (
    Device & device,
    uint32_t maxSets,
    VkDescriptorPoolCreateFlags poolFlags,
    const std::vector< VkDescriptorPoolSize > & poolSizes)
```

Definition at line 5 of file [pool.cpp](#).

References [ven::Device::device\(\)](#), [m_descriptorPool](#), and [m_device](#).

Here is the call graph for this function:



7.10.2.2 ~DescriptorPool()

```
ven::DescriptorPool::~~DescriptorPool () [inline]
```

Definition at line 48 of file [Pool.hpp](#).

References [ven::Device::device\(\)](#), [m_descriptorPool](#), and [m_device](#).

Here is the call graph for this function:



7.10.2.3 DescriptorPool() [2/2]

```
ven::DescriptorPool::DescriptorPool (
    const DescriptorPool & ) [delete]
```

7.10.3 Member Function Documentation

7.10.3.1 allocateDescriptor()

```
bool ven::DescriptorPool::allocateDescriptor (
    VkDescriptorSetLayout descriptorSetLayout,
    VkDescriptorSet & descriptor) const
```

Definition at line 20 of file [pool.cpp](#).

7.10.3.2 freeDescriptors()

```
void ven::DescriptorPool::freeDescriptors (
    const std::vector< VkDescriptorSet > & descriptors) const [inline]
```

Definition at line 54 of file [Pool.hpp](#).

References [ven::Device::device\(\)](#), [m_descriptorPool](#), and [m_device](#).

Here is the call graph for this function:



7.10.3.3 getDescriptorPool()

```
VkDescriptorPool ven::DescriptorPool::getDescriptorPool () const [inline], [nodiscard]
```

Definition at line 57 of file [Pool.hpp](#).

References [m_descriptorPool](#).

7.10.3.4 operator=()

```
DescriptorPool & ven::DescriptorPool::operator= (
    const DescriptorPool & ) [delete]
```

7.10.3.5 resetPool()

```
void ven::DescriptorPool::resetPool () const [inline]
```

Definition at line 55 of file [Pool.hpp](#).

References [ven::Device::device\(\)](#), [m_descriptorPool](#), and [m_device](#).

Here is the call graph for this function:



7.10.4 Friends And Related Symbol Documentation

7.10.4.1 DescriptorWriter

```
friend class DescriptorWriter [friend]
```

Definition at line 63 of file [Pool.hpp](#).

7.10.5 Member Data Documentation

7.10.5.1 m_descriptorPool

```
VkDescriptorPool ven::DescriptorPool::m_descriptorPool [private]
```

Definition at line 62 of file [Pool.hpp](#).

Referenced by [DescriptorPool\(\)](#), [freeDescriptors\(\)](#), [getDescriptorPool\(\)](#), [resetPool\(\)](#), and [~DescriptorPool\(\)](#).

7.10.5.2 m_device

```
Device& ven::DescriptorPool::m_device [private]
```

Definition at line 61 of file [Pool.hpp](#).

Referenced by [DescriptorPool\(\)](#), [freeDescriptors\(\)](#), [resetPool\(\)](#), and [~DescriptorPool\(\)](#).

The documentation for this class was generated from the following files:

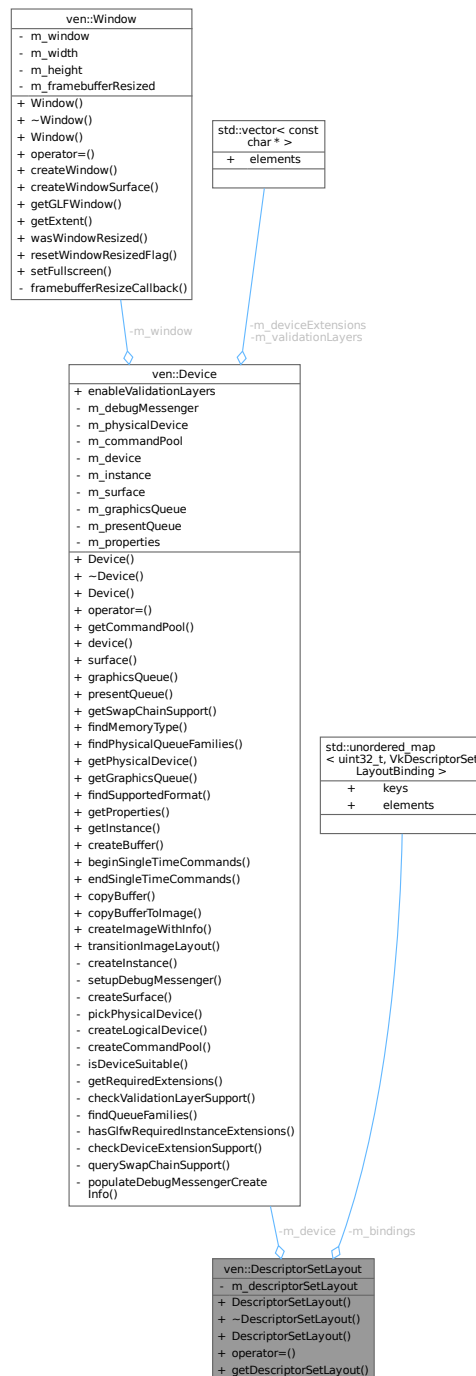
- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/Pool.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/Descriptors/pool.cpp](#)

7.11 ven::DescriptorSetLayout Class Reference

Class for descriptor set layout.

```
#include <SetLayout.hpp>
```

Collaboration diagram for ven::DescriptorSetLayout:



Classes

- class [Builder](#)

Public Member Functions

- [DescriptorSetLayout](#) ([Device](#) &device, const std::unordered_map< uint32_t, VkDescriptorSetLayoutBinding > &bindings)

- [~DescriptorSetLayout\(\)](#)
- [DescriptorSetLayout\(const DescriptorSetLayout &\)=delete](#)
- [DescriptorSetLayout & operator=\(const DescriptorSetLayout &\)=delete](#)
- [VkDescriptorSetLayout getDescriptorSetLayout\(\)](#) const

Private Attributes

- [Device](#) & [m_device](#)
- [VkDescriptorSetLayout m_descriptorSetLayout](#)
- [std::unordered_map< uint32_t, VkDescriptorSetLayoutBinding > m_bindings](#)

Friends

- class [DescriptorWriter](#)

7.11.1 Detailed Description

Class for descriptor set layout.

Definition at line 21 of file [SetLayout.hpp](#).

7.11.2 Constructor & Destructor Documentation

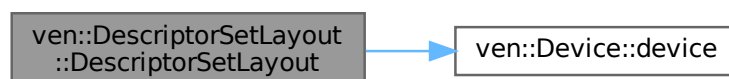
7.11.2.1 DescriptorSetLayout() [1/2]

```
ven::DescriptorSetLayout::DescriptorSetLayout (
    Device & device,
    const std::unordered_map< uint32_t, VkDescriptorSetLayoutBinding > & bindings)
```

Definition at line 17 of file [setLayout.cpp](#).

References [ven::Device::device\(\)](#), [m_descriptorSetLayout](#), and [m_device](#).

Here is the call graph for this function:



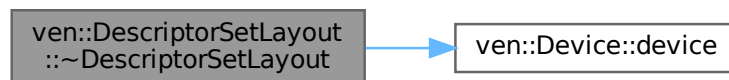
7.11.2.2 ~DescriptorSetLayout()

```
ven::DescriptorSetLayout::~~DescriptorSetLayout () [inline]
```

Definition at line 42 of file [SetLayout.hpp](#).

References [ven::Device::device\(\)](#), [m_descriptorSetLayout](#), and [m_device](#).

Here is the call graph for this function:



7.11.2.3 DescriptorSetLayout() [2/2]

```
ven::DescriptorSetLayout::DescriptorSetLayout (
    const DescriptorSetLayout & ) [delete]
```

7.11.3 Member Function Documentation

7.11.3.1 getDescriptorSetLayout()

```
VkDescriptorSetLayout ven::DescriptorSetLayout::getDescriptorSetLayout () const [inline]
```

Definition at line 47 of file [SetLayout.hpp](#).

References [m_descriptorSetLayout](#).

7.11.3.2 operator=()

```
DescriptorSetLayout & ven::DescriptorSetLayout::operator= (
    const DescriptorSetLayout & ) [delete]
```

7.11.4 Friends And Related Symbol Documentation

7.11.4.1 DescriptorWriter

```
friend class DescriptorWriter [friend]
```

Definition at line 55 of file [SetLayout.hpp](#).

7.11.5 Member Data Documentation

7.11.5.1 m_bindings

```
std::unordered_map<uint32_t, VkDescriptorSetLayoutBinding> ven::DescriptorSetLayout::m_bindings [private]
```

Definition at line 53 of file [SetLayout.hpp](#).

Referenced by [ven::DescriptorWriter::writeBuffer\(\)](#).

7.11.5.2 m_descriptorSetLayout

```
VkDescriptorSetLayout ven::DescriptorSetLayout::m_descriptorSetLayout [private]
```

Definition at line 52 of file [SetLayout.hpp](#).

Referenced by [DescriptorSetLayout\(\)](#), [getDescriptorSetLayout\(\)](#), and [~DescriptorSetLayout\(\)](#).

7.11.5.3 m_device

```
Device& ven::DescriptorSetLayout::m_device [private]
```

Definition at line 51 of file [SetLayout.hpp](#).

Referenced by [DescriptorSetLayout\(\)](#), and [~DescriptorSetLayout\(\)](#).

The documentation for this class was generated from the following files:

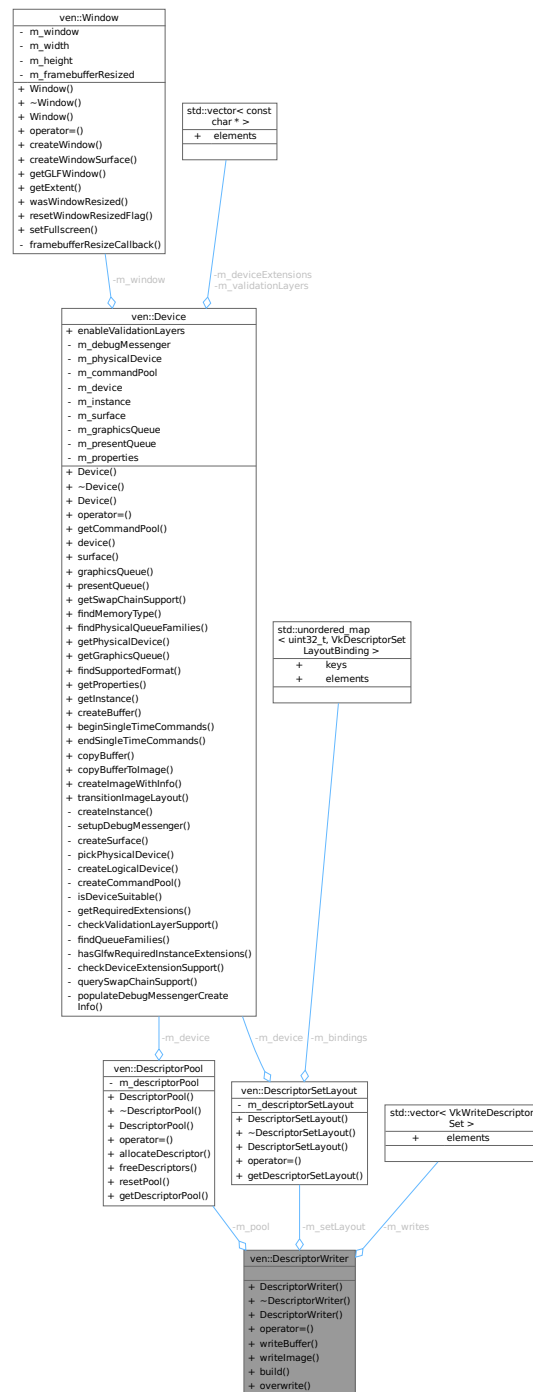
- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/SetLayout.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/Descriptors/setLayout.cpp](#)

7.12 ven::DescriptorWriter Class Reference

Class for descriptor writer.

```
#include <Writer.hpp>
```

Collaboration diagram for ven::DescriptorWriter:



Public Member Functions

- `DescriptorWriter` (`DescriptorSetLayout` &setLayout, `DescriptorPool` &pool)
- `~DescriptorWriter` ()=default
- `DescriptorWriter` (const `DescriptorWriter` &)=delete
- `DescriptorWriter` & operator= (const `DescriptorWriter` &)=delete
- `DescriptorWriter` & writeBuffer (uint32_t binding, const `VkDescriptorBufferInfo` *bufferInfo)

- [DescriptorWriter](#) & [writeImage](#) (uint32_t binding, const VkDescriptorImageInfo *imageInfo)
- bool [build](#) (VkDescriptorSet &set)
- void [overwrite](#) (const VkDescriptorSet &set)

Private Attributes

- [DescriptorSetLayout](#) & [m_setLayout](#)
- [DescriptorPool](#) & [m_pool](#)
- std::vector< VkWriteDescriptorSet > [m_writes](#)

7.12.1 Detailed Description

Class for descriptor writer.

Definition at line 19 of file [Writer.hpp](#).

7.12.2 Constructor & Destructor Documentation

7.12.2.1 DescriptorWriter() [1/2]

```
ven::DescriptorWriter::DescriptorWriter (
    DescriptorSetLayout & setLayout,
    DescriptorPool & pool) [inline]
```

Definition at line 23 of file [Writer.hpp](#).

7.12.2.2 ~DescriptorWriter()

```
ven::DescriptorWriter::~DescriptorWriter () [default]
```

7.12.2.3 DescriptorWriter() [2/2]

```
ven::DescriptorWriter::DescriptorWriter (
    const DescriptorWriter & ) [delete]
```

7.12.3 Member Function Documentation

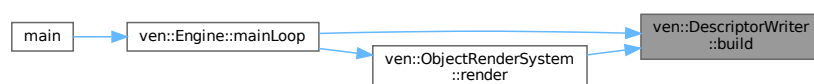
7.12.3.1 build()

```
bool ven::DescriptorWriter::build (
    VkDescriptorSet & set)
```

Definition at line 43 of file [writer.cpp](#).

Referenced by [ven::Engine::mainLoop\(\)](#), and [ven::ObjectRenderSystem::render\(\)](#).

Here is the caller graph for this function:



7.12.3.2 operator=()

```
DescriptorWriter & ven::DescriptorWriter::operator= (
    const DescriptorWriter & ) [delete]
```

7.12.3.3 overwrite()

```
void ven::DescriptorWriter::overwrite (
    const VkDescriptorSet & set)
```

Definition at line 52 of file [writer.cpp](#).

7.12.3.4 writeBuffer()

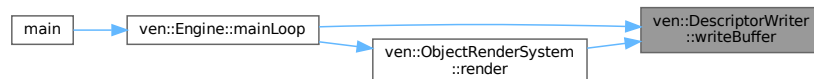
```
ven::DescriptorWriter & ven::DescriptorWriter::writeBuffer (
    uint32_t binding,
    const VkDescriptorBufferInfo * bufferInfo)
```

Definition at line 5 of file [writer.cpp](#).

References [ven::DescriptorSetLayout::m_bindings](#), [m_setLayout](#), and [m_writes](#).

Referenced by [ven::Engine::mainLoop\(\)](#), and [ven::ObjectRenderSystem::render\(\)](#).

Here is the caller graph for this function:



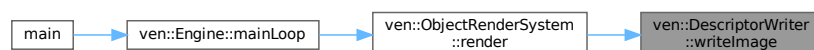
7.12.3.5 writelImage()

```
ven::DescriptorWriter & ven::DescriptorWriter::writeImage (
    uint32_t binding,
    const VkDescriptorImageInfo * imageInfo)
```

Definition at line 24 of file [writer.cpp](#).

Referenced by [ven::ObjectRenderSystem::render\(\)](#).

Here is the caller graph for this function:



7.12.4 Member Data Documentation

7.12.4.1 m_pool

`DescriptorPool& ven::DescriptorWriter::m_pool [private]`

Definition at line 38 of file [Writer.hpp](#).

7.12.4.2 m_setLayout

`DescriptorSetLayout& ven::DescriptorWriter::m_setLayout [private]`

Definition at line 37 of file [Writer.hpp](#).

Referenced by [writeBuffer\(\)](#).

7.12.4.3 m_writes

`std::vector<VkWriteDescriptorSet> ven::DescriptorWriter::m_writes [private]`

Definition at line 39 of file [Writer.hpp](#).

Referenced by [writeBuffer\(\)](#).

The documentation for this class was generated from the following files:

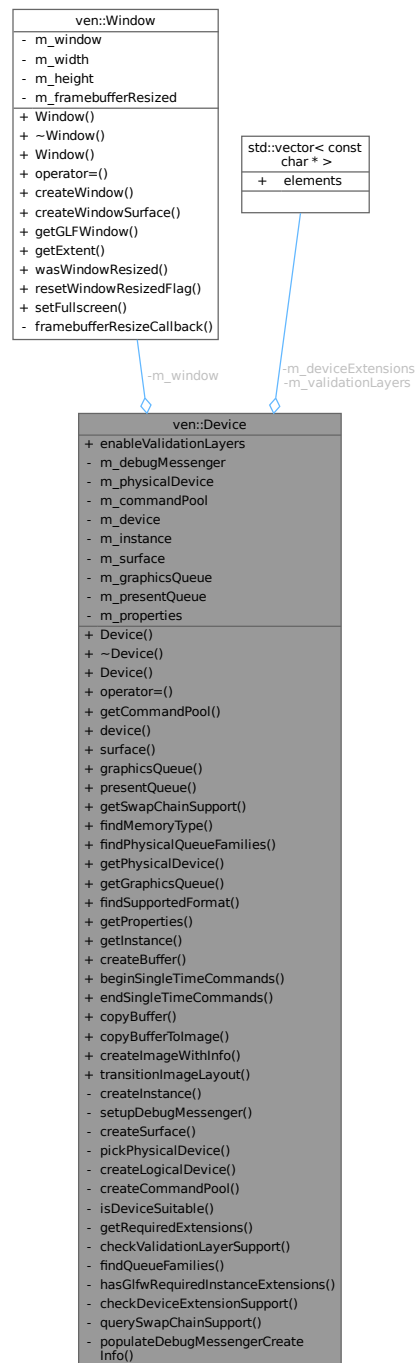
- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/Writer.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/Descriptors/writer.cpp](#)

7.13 ven::Device Class Reference

Class for device.

```
#include <Device.hpp>
```

Collaboration diagram for ven::Device:



Public Member Functions

- [Device](#) ([Window](#) &window)
- [~Device](#) ()
- [Device](#) (const [Device](#) &)=delete
- [Device](#) & [operator=](#) (const [Device](#) &)=delete
- [VkCommandPool](#) [getCommandPool](#) () const

- VkDevice [device](#) () const
- VkSurfaceKHR [surface](#) () const
- VkQueue [graphicsQueue](#) () const
- VkQueue [presentQueue](#) () const
- [SwapChainSupportDetails](#) [getSwapChainSupport](#) () const
- uint32_t [findMemoryType](#) (uint32_t typeFilter, VkMemoryPropertyFlags properties) const
- [QueueFamilyIndices](#) [findPhysicalQueueFamilies](#) () const
- VkPhysicalDevice [getPhysicalDevice](#) () const
- VkQueue [getGraphicsQueue](#) () const
- VkFormat [findSupportedFormat](#) (const std::vector< VkFormat > &candidates, VkImageTiling tiling, VkFormatFeatureFlags features) const
- VkPhysicalDeviceProperties [getProperties](#) () const
- VkInstance [getInstance](#) () const
- void [createBuffer](#) (VkDeviceSize size, VkBufferUsageFlags usage, VkMemoryPropertyFlags properties, VkBuffer &buffer, VkDeviceMemory &bufferMemory) const
- VkCommandBuffer [beginSingleTimeCommands](#) () const
- void [endSingleTimeCommands](#) (VkCommandBuffer commandBuffer) const
- void [copyBuffer](#) (VkBuffer srcBuffer, VkBuffer dstBuffer, VkDeviceSize size) const
- void [copyBufferToImage](#) (VkBuffer buffer, VkImage image, uint32_t width, uint32_t height, uint32_t layerCount) const
- void [createImageWithInfo](#) (const VkImageCreateInfo &imageInfo, VkMemoryPropertyFlags properties, VkImage &image, VkDeviceMemory &imageMemory) const
- void [transitionImageLayout](#) (VkImage image, VkFormat format, VkImageLayout oldLayout, VkImageLayout newLayout, uint32_t mipLevels=1, uint32_t layerCount=1) const

Public Attributes

- const bool [enableValidationLayers](#) = true

Private Member Functions

- void [createInstance](#) ()
- void [setupDebugMessenger](#) ()
- void [createSurface](#) ()
- void [pickPhysicalDevice](#) ()
- void [createLogicalDevice](#) ()
- void [createCommandPool](#) ()
- bool [isDeviceSuitable](#) (VkPhysicalDevice [device](#)) const
- std::vector< const char * > [getRequiredExtensions](#) () const
- bool [checkValidationLayerSupport](#) () const
- [QueueFamilyIndices](#) [findQueueFamilies](#) (VkPhysicalDevice [device](#)) const
- void [hasGlfwRequiredInstanceExtensions](#) () const
- bool [checkDeviceExtensionSupport](#) (VkPhysicalDevice [device](#)) const
- [SwapChainSupportDetails](#) [querySwapChainSupport](#) (VkPhysicalDevice [device](#)) const

Static Private Member Functions

- static void [populateDebugMessengerCreateInfo](#) (VkDebugUtilsMessengerCreateInfoEXT &createInfo)

Private Attributes

- [Window](#) & [m_window](#)
- [VkDebugUtilsMessengerEXT](#) [m_debugMessenger](#)
- [VkPhysicalDevice](#) [m_physicalDevice](#) = VK_NULL_HANDLE
- [VkCommandPool](#) [m_commandPool](#)
- [VkDevice](#) [m_device](#)
- [VkInstance](#) [m_instance](#)
- [VkSurfaceKHR](#) [m_surface](#)
- [VkQueue](#) [m_graphicsQueue](#)
- [VkQueue](#) [m_presentQueue](#)
- [VkPhysicalDeviceProperties](#) [m_properties](#)
- `const std::vector< const char * >` [m_validationLayers](#) = {"VK_LAYER_KHRONOS_validation"}
- `const std::vector< const char * >` [m_deviceExtensions](#) = {VK_KHR_SWAPCHAIN_EXTENSION_NAME}

7.13.1 Detailed Description

Class for device.

Definition at line 35 of file [Device.hpp](#).

7.13.2 Constructor & Destructor Documentation

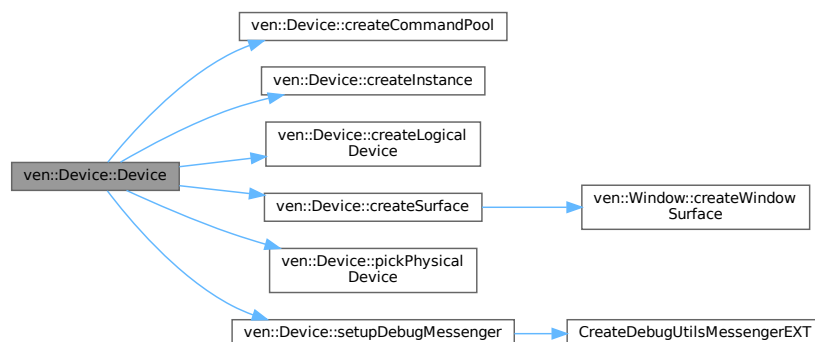
7.13.2.1 Device() [1/2]

```
ven::Device::Device (
    Window & window) [explicit]
```

Definition at line 32 of file [device.cpp](#).

References [createCommandPool\(\)](#), [createInstance\(\)](#), [createLogicalDevice\(\)](#), [createSurface\(\)](#), [pickPhysicalDevice\(\)](#), and [setupDebugMessenger\(\)](#).

Here is the call graph for this function:



7.13.2.2 ~Device()

```
ven::Device::~~Device ()
```

Definition at line 42 of file [device.cpp](#).

References [DestroyDebugUtilsMessengerEXT\(\)](#).

Here is the call graph for this function:



7.13.2.3 Device() [2/2]

```
ven::Device::Device (
    const Device & ) [delete]
```

7.13.3 Member Function Documentation

7.13.3.1 beginSingleTimeCommands()

```
VkCommandBuffer ven::Device::beginSingleTimeCommands () const [nodiscard]
```

Definition at line 413 of file [device.cpp](#).

7.13.3.2 checkDeviceExtensionSupport()

```
bool ven::Device::checkDeviceExtensionSupport (
    VkPhysicalDevice device) const [private]
```

Definition at line 290 of file [device.cpp](#).

7.13.3.3 checkValidationLayerSupport()

```
bool ven::Device::checkValidationLayerSupport () const [nodiscard], [private]
```

Definition at line 227 of file [device.cpp](#).

7.13.3.4 copyBuffer()

```
void ven::Device::copyBuffer (
    VkBuffer srcBuffer,
    VkBuffer dstBuffer,
    VkDeviceSize size) const
```

Definition at line 447 of file [device.cpp](#).

7.13.3.5 copyBufferToImage()

```
void ven::Device::copyBufferToImage (
    VkBuffer buffer,
    VkImage image,
    uint32_t width,
    uint32_t height,
    uint32_t layerCount) const
```

Definition at line 460 of file [device.cpp](#).

7.13.3.6 createBuffer()

```
void ven::Device::createBuffer (
    VkDeviceSize size,
    VkBufferUsageFlags usage,
    VkMemoryPropertyFlags properties,
    VkBuffer & buffer,
    VkDeviceMemory & bufferMemory) const
```

Definition at line 384 of file [device.cpp](#).

Referenced by [ven::Buffer::Buffer\(\)](#).

Here is the caller graph for this function:



7.13.3.7 createCommandPool()

```
void ven::Device::createCommandPool () [private]
```

Definition at line 171 of file [device.cpp](#).

Referenced by [Device\(\)](#).

Here is the caller graph for this function:



7.13.3.8 createImageWithInfo()

```
void ven::Device::createImageWithInfo (
    const VkImageCreateInfo & imageInfo,
    VkMemoryPropertyFlags properties,
    VkImage & image,
    VkDeviceMemory & imageMemory) const
```

Definition at line 481 of file [device.cpp](#).

Referenced by [ven::Texture::Texture\(\)](#).

Here is the caller graph for this function:



7.13.3.9 createInstance()

```
void ven::Device::createInstance () [private]
```

Definition at line 55 of file [device.cpp](#).

Referenced by [Device\(\)](#).

Here is the caller graph for this function:



7.13.3.10 createLogicalDevice()

```
void ven::Device::createLogicalDevice () [private]
```

Definition at line 124 of file [device.cpp](#).

Referenced by [Device\(\)](#).

Here is the caller graph for this function:



7.13.3.11 createSurface()

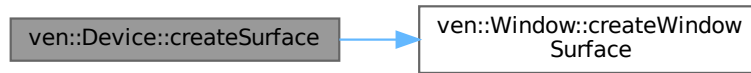
```
void ven::Device::createSurface () [inline], [private]
```

Definition at line 80 of file [Device.hpp](#).

References [ven::Window::createWindowSurface\(\)](#), [m_instance](#), [m_surface](#), and [m_window](#).

Referenced by [Device\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.13.3.12 device()

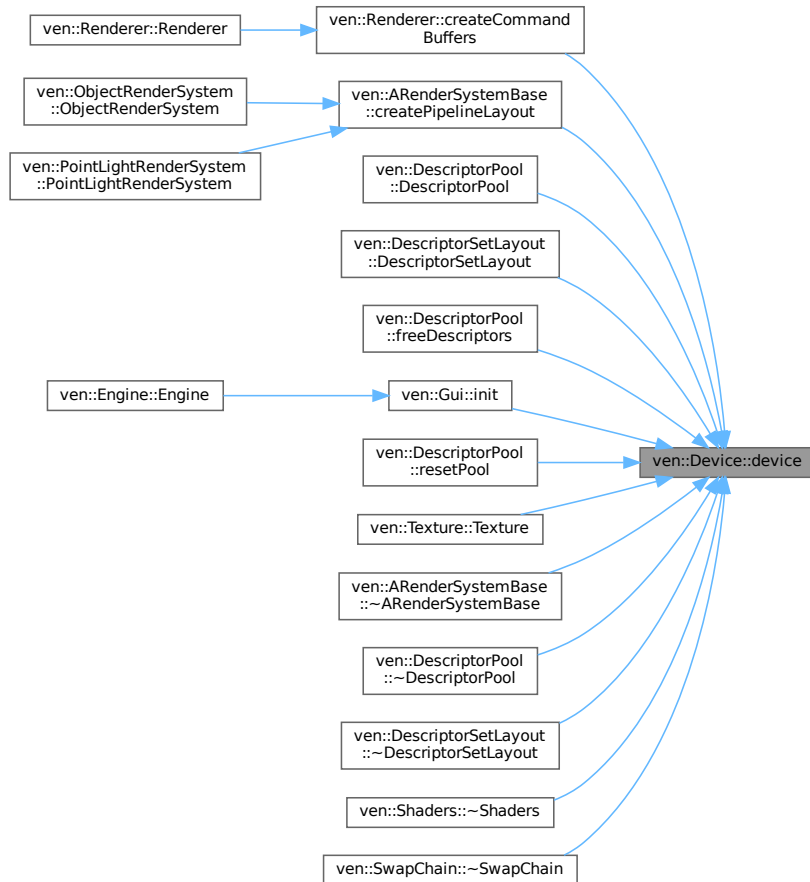
```
VkDevice ven::Device::device () const [inline], [nodiscard]
```

Definition at line 52 of file [Device.hpp](#).

References [m_device](#).

Referenced by [ven::Renderer::createCommandBuffers\(\)](#), [ven::ARenderSystemBase::createPipelineLayout\(\)](#), [ven::DescriptorPool::DescriptorPool\(\)](#), [ven::DescriptorSetLayout::DescriptorSetLayout\(\)](#), [ven::DescriptorPool::freeDescriptors\(\)](#), [ven::Gui::init\(\)](#), [ven::DescriptorPool::resetPool\(\)](#), [ven::Texture::Texture\(\)](#), [ven::ARenderSystemBase::~~ARenderSystemBase\(\)](#), [ven::DescriptorPool::~~DescriptorPool\(\)](#), [ven::DescriptorSetLayout::~~DescriptorSetLayout\(\)](#), [ven::Shaders::~~Shaders\(\)](#), and [ven::SwapChain::~~SwapChain\(\)](#).

Here is the caller graph for this function:



7.13.3.13 endSingleTimeCommands()

```
void ven::Device::endSingleTimeCommands (
    VkCommandBuffer commandBuffer) const
```

Definition at line 432 of file [device.cpp](#).

7.13.3.14 findMemoryType()

```
uint32_t ven::Device::findMemoryType (
    uint32_t typeFilter,
    VkMemoryPropertyFlags properties) const [nodiscard]
```

Definition at line 369 of file [device.cpp](#).

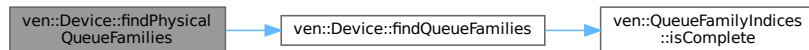
7.13.3.15 findPhysicalQueueFamilies()

```
QueueFamilyIndices ven::Device::findPhysicalQueueFamilies () const [inline], [nodiscard]
```

Definition at line 59 of file [Device.hpp](#).

References [findQueueFamilies\(\)](#), and [m_physicalDevice](#).

Here is the call graph for this function:



7.13.3.16 findQueueFamilies()

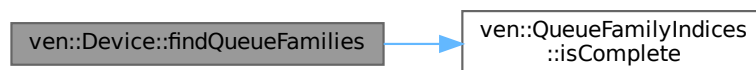
```
ven::QueueFamilyIndices ven::Device::findQueueFamilies (
    VkPhysicalDevice device) const [private]
```

Definition at line 306 of file [device.cpp](#).

References [ven::QueueFamilyIndices::graphicsFamily](#), [ven::QueueFamilyIndices::graphicsFamilyHasValue](#), [ven::QueueFamilyIndices::isComplete\(\)](#), [ven::QueueFamilyIndices::presentFamily](#), and [ven::QueueFamilyIndices::presentFamilyHasValue](#).

Referenced by [findPhysicalQueueFamilies\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.13.3.17 findSupportedFormat()

```
VkFormat ven::Device::findSupportedFormat (
    const std::vector< VkFormat > & candidates,
    VkImageTiling tiling,
    VkFormatFeatureFlags features) const [nodiscard]
```

Definition at line 355 of file [device.cpp](#).

7.13.3.18 getCommandPool()

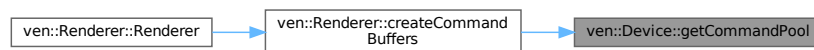
```
VkCommandPool ven::Device::getCommandPool () const [inline], [nodiscard]
```

Definition at line 51 of file [Device.hpp](#).

References [m_commandPool](#).

Referenced by [ven::Renderer::createCommandBuffers\(\)](#).

Here is the caller graph for this function:



7.13.3.19 getGraphicsQueue()

```
VkQueue ven::Device::getGraphicsQueue () const [inline], [nodiscard]
```

Definition at line 61 of file [Device.hpp](#).

References [m_graphicsQueue](#).

7.13.3.20 getInstance()

```
VkInstance ven::Device::getInstance () const [inline], [nodiscard]
```

Definition at line 64 of file [Device.hpp](#).

References [m_instance](#).

Referenced by [ven::Engine::Engine\(\)](#).

Here is the caller graph for this function:



7.13.3.21 getPhysicalDevice()

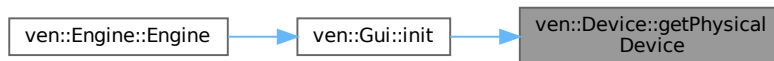
```
VkPhysicalDevice ven::Device::getPhysicalDevice () const [inline], [nodiscard]
```

Definition at line 60 of file [Device.hpp](#).

References [m_physicalDevice](#).

Referenced by [ven::Gui::init\(\)](#).

Here is the caller graph for this function:



7.13.3.22 getProperties()

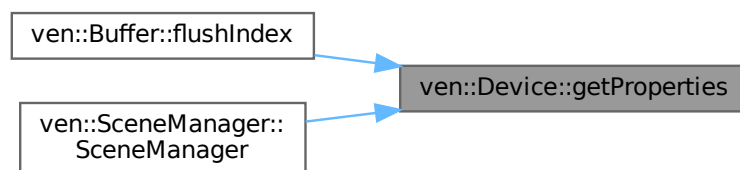
```
VkPhysicalDeviceProperties ven::Device::getProperties () const [inline], [nodiscard]
```

Definition at line 63 of file [Device.hpp](#).

References [m_properties](#).

Referenced by [ven::Buffer::flushIndex\(\)](#), and [ven::SceneManager::SceneManager\(\)](#).

Here is the caller graph for this function:



7.13.3.23 getRequiredExtensions()

```
std::vector< const char * > ven::Device::getRequiredExtensions () const [nodiscard], [private]
```

Definition at line 252 of file [device.cpp](#).

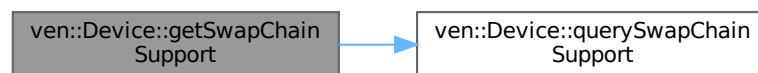
7.13.3.24 getSwapChainSupport()

```
SwapChainSupportDetails ven::Device::getSwapChainSupport () const [inline], [nodiscard]
```

Definition at line 57 of file [Device.hpp](#).

References [m_physicalDevice](#), and [querySwapChainSupport\(\)](#).

Here is the call graph for this function:



7.13.3.25 graphicsQueue()

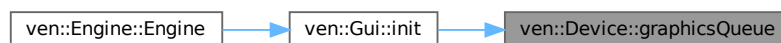
```
VkQueue ven::Device::graphicsQueue () const [inline], [nodiscard]
```

Definition at line 54 of file [Device.hpp](#).

References [m_graphicsQueue](#).

Referenced by [ven::Gui::init\(\)](#).

Here is the caller graph for this function:



7.13.3.26 hasGlfwRequiredInstanceExtensions()

```
void ven::Device::hasGlfwRequiredInstanceExtensions () const [private]
```

Definition at line 267 of file [device.cpp](#).

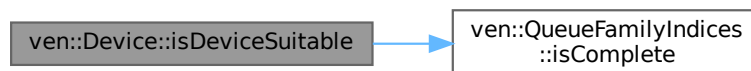
7.13.3.27 isDeviceSuitable()

```
bool ven::Device::isDeviceSuitable (
    VkPhysicalDevice device) const [private]
```

Definition at line 187 of file [device.cpp](#).

References [ven::QueueFamilyIndices::isComplete\(\)](#).

Here is the call graph for this function:



7.13.3.28 operator=()

```
Device & ven::Device::operator= (
    const Device & ) [delete]
```

7.13.3.29 pickPhysicalDevice()

```
void ven::Device::pickPhysicalDevice () [private]
```

Definition at line 98 of file [device.cpp](#).

Referenced by [Device\(\)](#).

Here is the caller graph for this function:



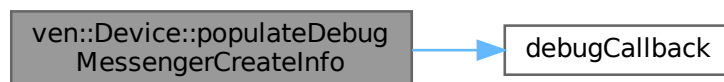
7.13.3.30 populateDebugMessengerCreateInfo()

```
void ven::Device::populateDebugMessengerCreateInfo (
    VkDebugUtilsMessengerCreateInfoEXT & createInfo) [static], [private]
```

Definition at line 204 of file [device.cpp](#).

References [debugCallback\(\)](#).

Here is the call graph for this function:



7.13.3.31 presentQueue()

```
VkQueue ven::Device::presentQueue () const [inline], [nodiscard]
```

Definition at line 55 of file [Device.hpp](#).

References [m_presentQueue](#).

7.13.3.32 querySwapChainSupport()

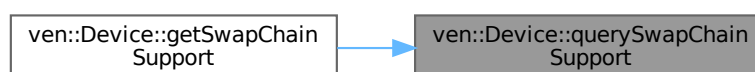
```
ven::SwapChainSupportDetails ven::Device::querySwapChainSupport (
    VkPhysicalDevice device) const [private]
```

Definition at line 334 of file [device.cpp](#).

References [ven::SwapChainSupportDetails::capabilities](#), [ven::SwapChainSupportDetails::formats](#), and [ven::SwapChainSupportDetails::capabilities](#).

Referenced by [getSwapChainSupport\(\)](#).

Here is the caller graph for this function:



7.13.3.33 `setupDebugMessenger()`

```
void ven::Device::setupDebugMessenger () [private]
```

Definition at line 217 of file [device.cpp](#).

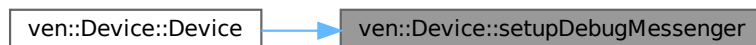
References [CreateDebugUtilsMessengerEXT\(\)](#).

Referenced by [Device\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.13.3.34 `surface()`

```
VkSurfaceKHR ven::Device::surface () const [inline], [nodiscard]
```

Definition at line 53 of file [Device.hpp](#).

References [m_surface](#).

7.13.3.35 `transitionImageLayout()`

```
void ven::Device::transitionImageLayout (  
    VkImage image,  
    VkFormat format,  
    VkImageLayout oldLayout,  
    VkImageLayout newLayout,  
    uint32_t mipLevels = 1,  
    uint32_t layerCount = 1) const
```

Definition at line 504 of file [device.cpp](#).

7.13.4 Member Data Documentation

7.13.4.1 enableValidationLayers

```
const bool ven::Device::enableValidationLayers = true
```

Definition at line 42 of file [Device.hpp](#).

7.13.4.2 m_commandPool

```
VkCommandPool ven::Device::m_commandPool [private]
```

Definition at line 98 of file [Device.hpp](#).

Referenced by [getCommandPool\(\)](#).

7.13.4.3 m_debugMessenger

```
VkDebugUtilsMessengerEXT ven::Device::m_debugMessenger [private]
```

Definition at line 96 of file [Device.hpp](#).

7.13.4.4 m_device

```
VkDevice ven::Device::m_device [private]
```

Definition at line 99 of file [Device.hpp](#).

Referenced by [device\(\)](#).

7.13.4.5 m_deviceExtensions

```
const std::vector<const char *> ven::Device::m_deviceExtensions = {VK_KHR_SWAPCHAIN_EXTENSION↵_NAME} [private]
```

Definition at line 107 of file [Device.hpp](#).

7.13.4.6 m_graphicsQueue

```
VkQueue ven::Device::m_graphicsQueue [private]
```

Definition at line 102 of file [Device.hpp](#).

Referenced by [getGraphicsQueue\(\)](#), and [graphicsQueue\(\)](#).

7.13.4.7 m_instance

```
VkInstance ven::Device::m_instance [private]
```

Definition at line 100 of file [Device.hpp](#).

Referenced by [createSurface\(\)](#), and [getInstance\(\)](#).

7.13.4.8 m_physicalDevice

```
VkPhysicalDevice ven::Device::m_physicalDevice = VK_NULL_HANDLE [private]
```

Definition at line 97 of file [Device.hpp](#).

Referenced by [findPhysicalQueueFamilies\(\)](#), [getPhysicalDevice\(\)](#), and [getSwapChainSupport\(\)](#).

7.13.4.9 m_presentQueue

```
VkQueue ven::Device::m_presentQueue [private]
```

Definition at line 103 of file [Device.hpp](#).

Referenced by [presentQueue\(\)](#).

7.13.4.10 m_properties

```
VkPhysicalDeviceProperties ven::Device::m_properties [private]
```

Definition at line 104 of file [Device.hpp](#).

Referenced by [getProperties\(\)](#).

7.13.4.11 m_surface

```
VkSurfaceKHR ven::Device::m_surface [private]
```

Definition at line 101 of file [Device.hpp](#).

Referenced by [createSurface\(\)](#), and [surface\(\)](#).

7.13.4.12 m_validationLayers

```
const std::vector<const char *> ven::Device::m_validationLayers = {"VK_LAYER_KHRONOS_validation"}  
[private]
```

Definition at line 106 of file [Device.hpp](#).

7.13.4.13 m_window

```
Window& ven::Device::m_window [private]
```

Definition at line 95 of file [Device.hpp](#).

Referenced by [createSurface\(\)](#).

The documentation for this class was generated from the following files:

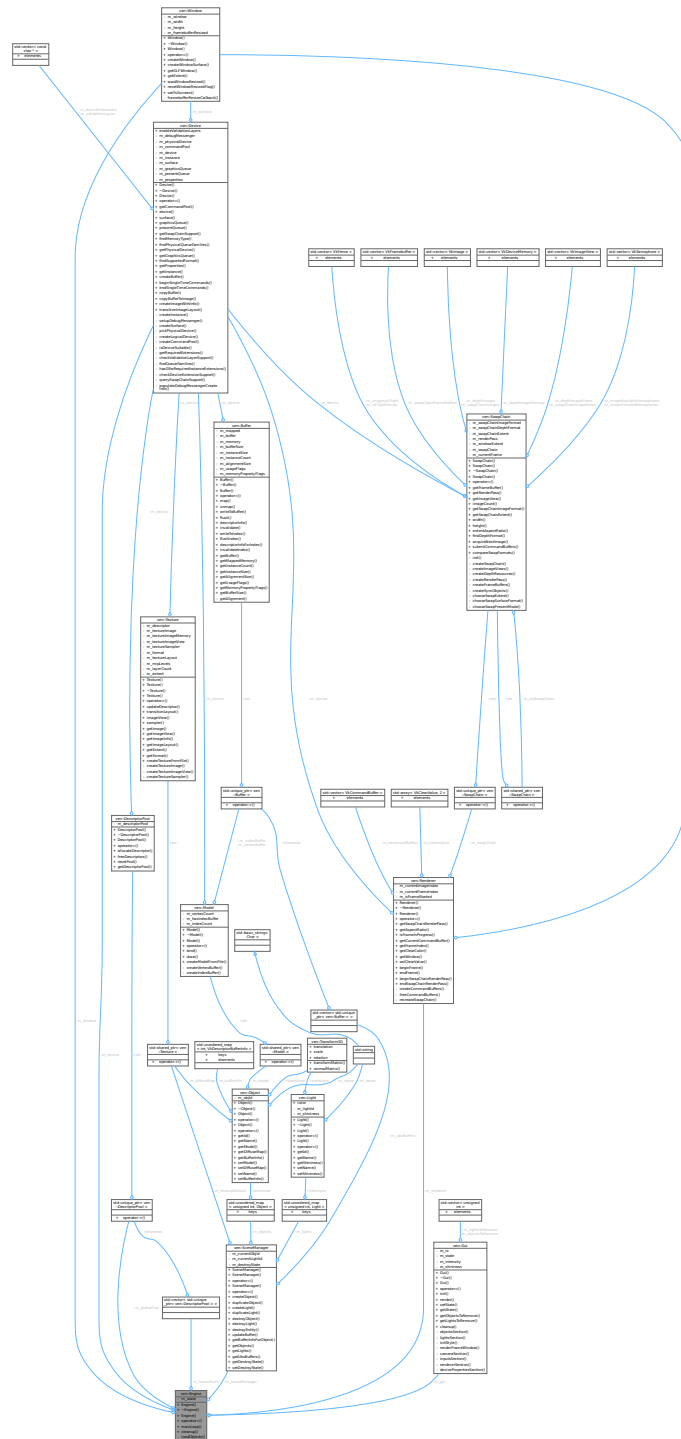
- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/Device.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Core/device.cpp](#)

7.14 ven::Engine Class Reference

Class for engine.

```
#include <Engine.hpp>
```

Collaboration diagram for ven::Engine:



Public Member Functions

- `Engine (uint32_t=DEFAULT_WIDTH, uint32_t=DEFAULT_HEIGHT, const std::string &title=DEFAULT_TITLE.data())`
- `~Engine ()=default`
- `Engine (const Engine &)=delete`
- `Engine operator= (const Engine &)=delete`
- `void mainLoop ()`
- `void cleanup ()`

Private Member Functions

- void [loadObjects](#) ()

Private Attributes

- [ENGINE_STATE](#) m_state {EXIT}
- [Window](#) m_window
- [Device](#) m_device {m_window}
- [Renderer](#) m_renderer {m_window, m_device}
- [Gui](#) m_gui
- std::unique_ptr< [DescriptorPool](#) > m_globalPool
- std::vector< std::unique_ptr< [DescriptorPool](#) > > m_framePools
- [SceneManager](#) m_sceneManager {m_device}

7.14.1 Detailed Description

Class for engine.

Definition at line 23 of file [Engine.hpp](#).

7.14.2 Constructor & Destructor Documentation

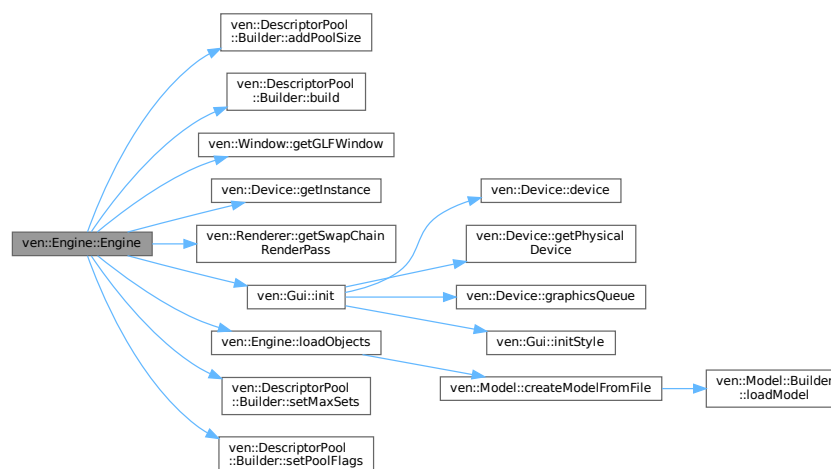
7.14.2.1 Engine() [1/2]

```
ven::Engine::Engine (
    uint32_t width = DEFAULT\_WIDTH,
    uint32_t height = DEFAULT\_HEIGHT,
    const std::string & title = DEFAULT\_TITLE.data()) [explicit]
```

Definition at line 9 of file [engine.cpp](#).

References [ven::DescriptorPool::Builder::addPoolSize\(\)](#), [ven::DescriptorPool::Builder::build\(\)](#), [ven::EDITOR](#), [ven::Window::getGLFWWindow\(\)](#), [ven::Device::getInstance\(\)](#), [ven::Renderer::getSwapChainRenderPass\(\)](#), [ven::Gui::init\(\)](#), [loadObjects\(\)](#), [m_device](#), [m_framePools](#), [m_globalPool](#), [m_gui](#), [m_renderer](#), [m_window](#), [ven::MAX_FRAMES_IN_FLIGHT](#), [ven::DescriptorPool::Builder::setMaxSets\(\)](#), and [ven::DescriptorPool::Builder::setPoolFlags\(\)](#).

Here is the call graph for this function:



7.14.2.2 ~Engine()

```
ven::Engine::~~Engine () [default]
```

7.14.2.3 Engine() [2/2]

```
ven::Engine::Engine (  
    const Engine & ) [delete]
```

7.14.3 Member Function Documentation

7.14.3.1 cleanup()

```
void ven::Engine::cleanup ()
```

Definition at line [149](#) of file [engine.cpp](#).

References [ven::Gui::cleanup\(\)](#).

Here is the call graph for this function:



7.14.3.2 loadObjects()

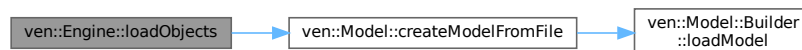
```
void ven::Engine::loadObjects () [private]
```

Definition at line [26](#) of file [engine.cpp](#).

References [ven::Colors::BLUE_4](#), [ven::Model::createModelFromFile\(\)](#), [ven::Colors::CYAN_4](#), [ven::Colors::GREEN_4](#), [ven::Colors::MAGENTA_4](#), [ven::Colors::RED_4](#), and [ven::Colors::YELLOW_4](#).

Referenced by [Engine\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.14.3.3 mainLoop()

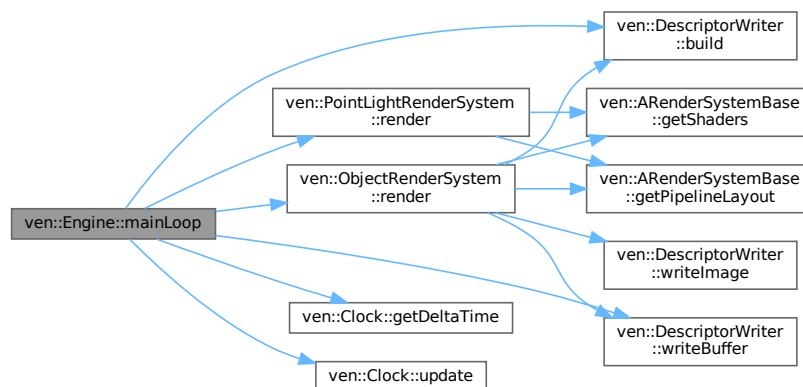
```
void ven::Engine::mainLoop ()
```

Definition at line 67 of file [engine.cpp](#).

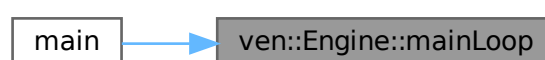
References [ven::DescriptorWriter::build\(\)](#), [ven::EXIT](#), [ven::FrameInfo::frameIndex](#), [ven::Clock::getDeltaTime\(\)](#), [ven::HIDDEN](#), [ven::MAX_FRAMES_IN_FLIGHT](#), [ven::ObjectRenderSystem::render\(\)](#), [ven::PointLightRenderSystem::render\(\)](#), [ven::Clock::update\(\)](#), and [ven::DescriptorWriter::writeBuffer\(\)](#).

Referenced by [main\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.14.3.4 operator=()

```
Engine ven::Engine::operator= (
    const Engine & ) [delete]
```

7.14.4 Member Data Documentation

7.14.4.1 m_device

```
Device ven::Engine::m_device {m_window} [private]
```

Definition at line 44 of file [Engine.hpp](#).

Referenced by [Engine\(\)](#).

7.14.4.2 m_framePools

```
std::vector<std::unique_ptr<DescriptorPool> > ven::Engine::m_framePools [private]
```

Definition at line 48 of file [Engine.hpp](#).

Referenced by [Engine\(\)](#).

7.14.4.3 m_globalPool

```
std::unique_ptr<DescriptorPool> ven::Engine::m_globalPool [private]
```

Definition at line 47 of file [Engine.hpp](#).

Referenced by [Engine\(\)](#).

7.14.4.4 m_gui

```
Gui ven::Engine::m_gui [private]
```

Definition at line 46 of file [Engine.hpp](#).

Referenced by [Engine\(\)](#).

7.14.4.5 m_renderer

```
Renderer ven::Engine::m_renderer {m_window, m_device} [private]
```

Definition at line 45 of file [Engine.hpp](#).

Referenced by [Engine\(\)](#).

7.14.4.6 m_sceneManager

```
SceneManager ven::Engine::m_sceneManager {m_device} [private]
```

Definition at line 49 of file [Engine.hpp](#).

7.14.4.7 m_state

```
ENGINE_STATE ven::Engine::m_state {EXIT} [private]
```

Definition at line 41 of file [Engine.hpp](#).

7.14.4.8 m_window

```
Window ven::Engine::m_window [private]
```

Definition at line 43 of file [Engine.hpp](#).

Referenced by [Engine\(\)](#).

The documentation for this class was generated from the following files:

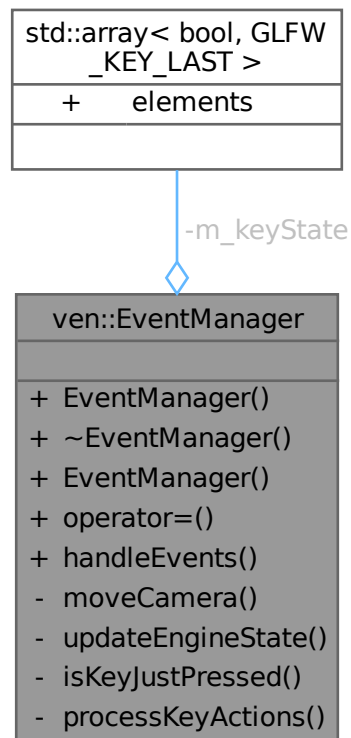
- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/Engine.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Core/engine.cpp](#)

7.15 ven::EventManager Class Reference

Class for event manager.

```
#include <EventManager.hpp>
```

Collaboration diagram for ven::EventManager:



Public Member Functions

- [EventManager](#) ()=default
- [~EventManager](#) ()=default
- [EventManager](#) (const [EventManager](#) &)=delete
- [EventManager](#) & [operator=](#) (const [EventManager](#) &)=delete
- void [handleEvents](#) (GLFWwindow *window, [ENGINE_STATE](#) *engineState, [Camera](#) &camera, [Gui](#) &gui, float dt) const

Static Private Member Functions

- static void [moveCamera](#) (GLFWwindow *window, [Camera](#) &camera, float dt)
- static void [updateEngineState](#) ([ENGINE_STATE](#) *engineState, const [ENGINE_STATE](#) newState)
- static bool [isKeyJustPressed](#) (GLFWwindow *window, long unsigned int key, std::array< bool, GLFW_KEY↵_LAST > &keyStates)
- template<typename Iterator >
static void [processKeyActions](#) (GLFWwindow *window, Iterator begin, Iterator end)

Private Attributes

- std::array< bool, GLFW_KEY_LAST > [m_keyState](#) {}

7.15.1 Detailed Description

Class for event manager.

Definition at line 42 of file [EventManager.hpp](#).

7.15.2 Constructor & Destructor Documentation

7.15.2.1 EventManager() [1/2]

```
ven::EventManager::EventManager () [default]
```

7.15.2.2 ~EventManager()

```
ven::EventManager::~EventManager () [default]
```

7.15.2.3 EventManager() [2/2]

```
ven::EventManager::EventManager (
    const EventManager & ) [delete]
```

7.15.3 Member Function Documentation

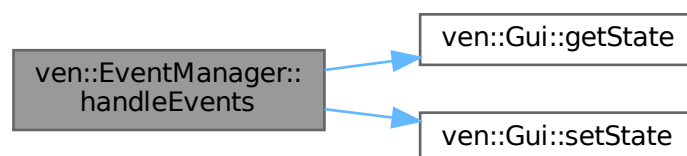
7.15.3.1 handleEvents()

```
void ven::EventManager::handleEvents (
    GLFWwindow * window,
    ENGINE\_STATE * engineState,
    Camera & camera,
    Gui & gui,
    float dt) const
```

Definition at line 60 of file [eventManager.cpp](#).

References [ven::DEFAULT_KEY_MAPPINGS](#), [ven::EDITOR](#), [ven::EXIT](#), [ven::Gui::getState\(\)](#), [ven::HIDDEN](#), [ven::Gui::setState\(\)](#), [ven::SHOW_EDITOR](#), [ven::SHOW_PLAYER](#), and [ven::KeyMappings::toggleGui](#).

Here is the call graph for this function:



7.15.3.2 isKeyJustPressed()

```
bool ven::EventManager::isKeyJustPressed (
    GLFWwindow * window,
    long unsigned int key,
    std::array< bool, GLFW_KEY_LAST > & keyStates) [static], [private]
```

Definition at line 6 of file [eventManager.cpp](#).

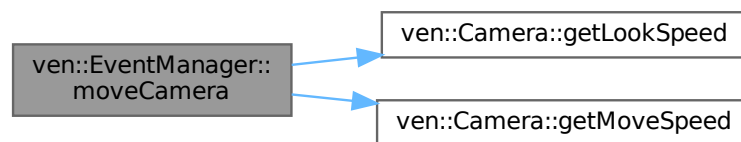
7.15.3.3 moveCamera()

```
void ven::EventManager::moveCamera (
    GLFWwindow * window,
    Camera & camera,
    float dt) [static], [private]
```

Definition at line 26 of file [eventManager.cpp](#).

References [ven::DEFAULT_KEY_MAPPINGS](#), [ven::EPSILON](#), [ven::Camera::getLookSpeed\(\)](#), [ven::Camera::getMoveSpeed\(\)](#), [ven::KeyMappings::lookDown](#), [ven::KeyMappings::lookLeft](#), [ven::KeyMappings::lookRight](#), [ven::KeyMappings::lookUp](#), [ven::KeyMappings::moveBackward](#), [ven::KeyMappings::moveDown](#), [ven::KeyMappings::moveForward](#), [ven::KeyMappings::moveLeft](#), [ven::KeyMappings::moveRight](#), [ven::KeyMappings::moveUp](#), [ven::Transform3D::rotation](#), [ven::Camera::transform](#), and [ven::Transform3D::translation](#).

Here is the call graph for this function:



7.15.3.4 operator=()

```
EventManager & ven::EventManager::operator= (
    const EventManager & ) [delete]
```

7.15.3.5 processKeyActions()

```
template<typename Iterator >
void ven::EventManager::processKeyActions (
    GLFWwindow * window,
    Iterator begin,
    Iterator end) [static], [private]
```

Definition at line 17 of file [eventManager.cpp](#).

7.15.3.6 updateEngineState()

```
static void ven::EventManager::updateEngineState (
    ENGINE_STATE * engineState,
    const ENGINE_STATE newState) [inline], [static], [private]
```

Definition at line 57 of file [EventManager.hpp](#).

7.15.4 Member Data Documentation

7.15.4.1 m_keyState

```
std::array<bool, GLFW_KEY_LAST> ven::EventManager::m_keyState {} [mutable], [private]
```

Definition at line 63 of file [EventManager.hpp](#).

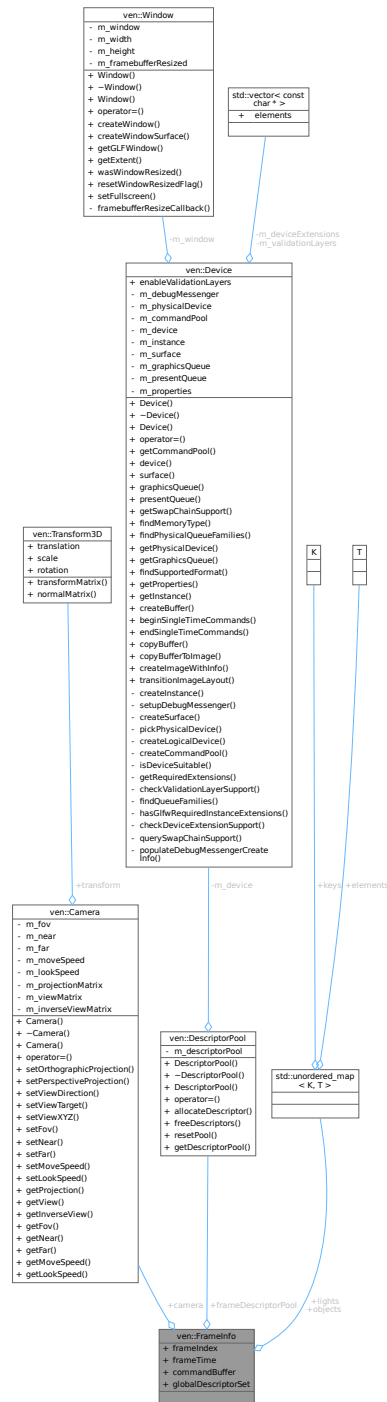
The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/EventManager.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Core/eventManager.cpp](#)

7.16 ven::FrameInfo Struct Reference

```
#include <FrameInfo.hpp>
```

Collaboration diagram for `ven::FrameInfo`:



Public Attributes

- unsigned long `frameIndex`
- float `frameTime`
- `VkCommandBuffer` `commandBuffer`
- `Camera` & `camera`
- `VkDescriptorSet` `globalDescriptorSet`

- [DescriptorPool](#) & [frameDescriptorPool](#)
- [Object::Map](#) & [objects](#)
- [Light::Map](#) & [lights](#)

7.16.1 Detailed Description

Definition at line 44 of file [FrameInfo.hpp](#).

7.16.2 Member Data Documentation

7.16.2.1 camera

[Camera](#)& ven::FrameInfo::camera

Definition at line 49 of file [FrameInfo.hpp](#).

7.16.2.2 commandBuffer

VkCommandBuffer ven::FrameInfo::commandBuffer

Definition at line 48 of file [FrameInfo.hpp](#).

Referenced by [ven::ObjectRenderSystem::render\(\)](#), and [ven::PointLightRenderSystem::render\(\)](#).

7.16.2.3 frameDescriptorPool

[DescriptorPool](#)& ven::FrameInfo::frameDescriptorPool

Definition at line 51 of file [FrameInfo.hpp](#).

Referenced by [ven::ObjectRenderSystem::render\(\)](#).

7.16.2.4 frameIndex

unsigned long ven::FrameInfo::frameIndex

Definition at line 46 of file [FrameInfo.hpp](#).

Referenced by [ven::Engine::mainLoop\(\)](#), and [ven::ObjectRenderSystem::render\(\)](#).

7.16.2.5 frameTime

float ven::FrameInfo::frameTime

Definition at line 47 of file [FrameInfo.hpp](#).

7.16.2.6 globalDescriptorSet

VkDescriptorSet ven::FrameInfo::globalDescriptorSet

Definition at line 50 of file [FrameInfo.hpp](#).

Referenced by [ven::ObjectRenderSystem::render\(\)](#), and [ven::PointLightRenderSystem::render\(\)](#).

7.16.2.7 lights

Light::Map& ven::FrameInfo::lights

Definition at line 53 of file [FrameInfo.hpp](#).

Referenced by [ven::PointLightRenderSystem::render\(\)](#).

7.16.2.8 objects

Object::Map& ven::FrameInfo::objects

Definition at line 52 of file [FrameInfo.hpp](#).

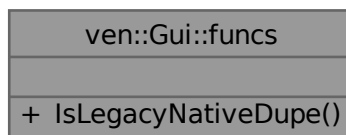
Referenced by [ven::ObjectRenderSystem::render\(\)](#).

The documentation for this struct was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/FrameInfo.hpp](#)

7.17 ven::Gui::funcs Struct Reference

Collaboration diagram for ven::Gui::funcs:



Static Public Member Functions

- static bool [IsLegacyNativeDupe](#) (const ImGuiKey key)

7.17.1 Detailed Description

Definition at line 66 of file [Gui.hpp](#).

7.17.2 Member Function Documentation

7.17.2.1 IsLegacyNativeDupe()

```
static bool ven::Gui::funcs::IsLegacyNativeDupe (  
    const ImGuiKey key) [inline], [static]
```

Definition at line 66 of file [Gui.hpp](#).

References [IsLegacyNativeDupe\(\)](#).

Referenced by [IsLegacyNativeDupe\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



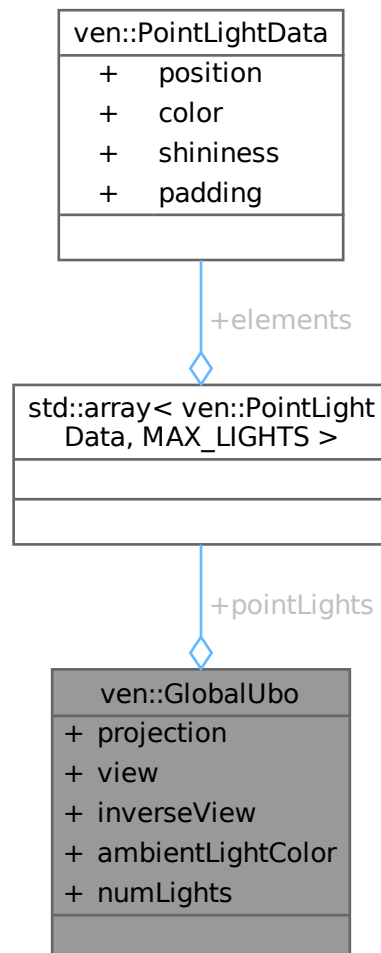
The documentation for this struct was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/Gui.hpp](#)

7.18 ven::GlobalUbo Struct Reference

```
#include <FrameInfo.hpp>
```

Collaboration diagram for ven::GlobalUbo:



Public Attributes

- glm::mat4 [projection](#) {1.F}
- glm::mat4 [view](#) {1.F}
- glm::mat4 [inverseView](#) {1.F}
- glm::vec4 [ambientLightColor](#) {DEFAULT_AMBIENT_LIGHT_COLOR}
- std::array< [PointLightData](#), MAX_LIGHTS > [pointLights](#)
- uint8_t [numLights](#)

7.18.1 Detailed Description

Definition at line 34 of file [FrameInfo.hpp](#).

7.18.2 Member Data Documentation

7.18.2.1 ambientLightColor

```
glm::vec4 ven::GlobalUbo::ambientLightColor {DEFAULT_AMBIENT_LIGHT_COLOR}
```

Definition at line 39 of file [FrameInfo.hpp](#).

Referenced by [ven::Gui::rendererSection\(\)](#).

7.18.2.2 inverseView

```
glm::mat4 ven::GlobalUbo::inverseView {1.F}
```

Definition at line 38 of file [FrameInfo.hpp](#).

7.18.2.3 numLights

```
uint8_t ven::GlobalUbo::numLights
```

Definition at line 41 of file [FrameInfo.hpp](#).

Referenced by [ven::SceneManager::updateBuffer\(\)](#).

7.18.2.4 pointLights

```
std::array<PointLightData, MAX_LIGHTS> ven::GlobalUbo::pointLights
```

Definition at line 40 of file [FrameInfo.hpp](#).

Referenced by [ven::SceneManager::updateBuffer\(\)](#).

7.18.2.5 projection

```
glm::mat4 ven::GlobalUbo::projection {1.F}
```

Definition at line 36 of file [FrameInfo.hpp](#).

7.18.2.6 view

```
glm::mat4 ven::GlobalUbo::view {1.F}
```

Definition at line 37 of file [FrameInfo.hpp](#).

The documentation for this struct was generated from the following file:

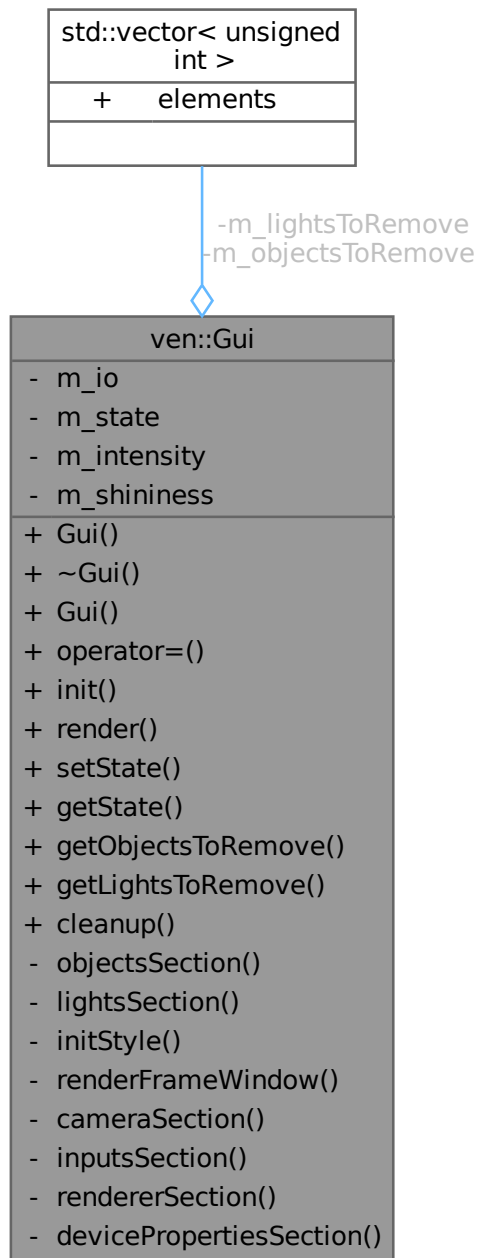
- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/FrameInfo.hpp](#)

7.19 ven::Gui Class Reference

Class for [Gui](#).

```
#include <Gui.hpp>
```

Collaboration diagram for ven::Gui:



Classes

- struct [ClockData](#)
- struct [funcs](#)

Public Member Functions

- [Gui](#) ()=default
- [~Gui](#) ()=default
- [Gui](#) (const [Gui](#) &)=delete
- [Gui](#) & [operator=](#) (const [Gui](#) &)=delete
- void [init](#) (GLFWwindow *window, VkInstance instance, const [Device](#) *device, VkRenderPass renderPass)
- void [render](#) ([Renderer](#) *renderer, [SceneManager](#) &sceneManager, [Camera](#) &camera, VkPhysicalDevice physicalDevice, [GlobalUbo](#) &ubo, const [ClockData](#) &clockData)
- void [setState](#) (const [GUI_STATE](#) state)
- [GUI_STATE](#) [getState](#) () const
- std::vector< unsigned int > * [getObjectsToRemove](#) ()
- std::vector< unsigned int > * [getLightsToRemove](#) ()

Static Public Member Functions

- static void [cleanup](#) ()

Private Member Functions

- void [objectsSection](#) ([SceneManager](#) &sceneManager)
- void [lightsSection](#) ([SceneManager](#) &sceneManager)

Static Private Member Functions

- static void [initStyle](#) ()
- static void [renderFrameWindow](#) (const [ClockData](#) &clockData)
- static void [cameraSection](#) ([Camera](#) &camera)
- static void [inputsSection](#) (const [ImGuiIO](#) &io)
- static void [rendererSection](#) ([Renderer](#) *renderer, [GlobalUbo](#) &ubo)
- static void [devicePropertiesSection](#) (VkPhysicalDeviceProperties deviceProperties)

Private Attributes

- [ImGuiIO](#) * [m_io](#) {nullptr}
- [GUI_STATE](#) [m_state](#) {HIDDEN}
- float [m_intensity](#) {1.0F}
- float [m_shininess](#) {DEFAULT_SHININESS}
- std::vector< unsigned int > [m_objectsToRemove](#)
- std::vector< unsigned int > [m_lightsToRemove](#)

7.19.1 Detailed Description

Class for [Gui](#).

Definition at line 30 of file [Gui.hpp](#).

7.19.2 Constructor & Destructor Documentation

7.19.2.1 Gui() [1/2]

```
ven::Gui::Gui () [default]
```

7.19.2.2 ~Gui()

```
ven::Gui::~Gui () [default]
```

7.19.2.3 Gui() [2/2]

```
ven::Gui::Gui (  
    const Gui & ) [delete]
```

7.19.3 Member Function Documentation

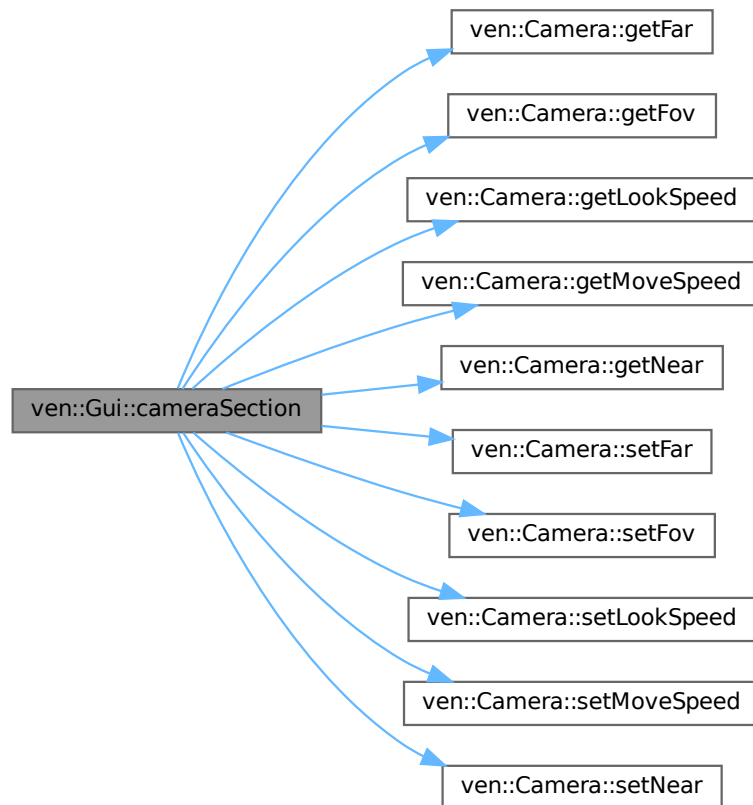
7.19.3.1 cameraSection()

```
void ven::Gui::cameraSection (  
    Camera & camera) [static], [private]
```

Definition at line 107 of file [render.cpp](#).

References [ven::DEFAULT_FAR](#), [ven::DEFAULT_FOV](#), [ven::DEFAULT_LOOK_SPEED](#), [ven::DEFAULT_MOVE_SPEED](#), [ven::DEFAULT_NEAR](#), [ven::DEFAULT_POSITION](#), [ven::DEFAULT_ROTATION](#), [ven::Camera::getFar\(\)](#), [ven::Camera::getFov\(\)](#), [ven::Camera::getLookSpeed\(\)](#), [ven::Camera::getMoveSpeed\(\)](#), [ven::Camera::getNear\(\)](#), [ven::Transform3D::rotation](#), [ven::Camera::setFar\(\)](#), [ven::Camera::setFov\(\)](#), [ven::Camera::setLookSpeed\(\)](#), [ven::Camera::setMoveSpeed\(\)](#), [ven::Camera::setNear\(\)](#), [ven::Camera::transform](#), and [ven::Transform3D::translation](#).

Here is the call graph for this function:



7.19.3.2 cleanup()

```
void ven::Gui::cleanup () [static]
```

Definition at line 9 of file [render.cpp](#).

Referenced by [ven::Engine::cleanup\(\)](#).

Here is the caller graph for this function:



7.19.3.3 devicePropertiesSection()

```
void ven::Gui::devicePropertiesSection (
    VkPhysicalDeviceProperties deviceProperties) [static], [private]
```

Definition at line 302 of file [render.cpp](#).

7.19.3.4 getLightsToRemove()

```
std::vector< unsigned int > * ven::Gui::getLightsToRemove () [inline], [nodiscard]
```

Definition at line 53 of file [Gui.hpp](#).

References [m_lightsToRemove](#).

7.19.3.5 getObjectsToRemove()

```
std::vector< unsigned int > * ven::Gui::getObjectsToRemove () [inline], [nodiscard]
```

Definition at line 52 of file [Gui.hpp](#).

References [m_objectsToRemove](#).

7.19.3.6 getState()

```
GUI_STATE ven::Gui::getState () const [inline], [nodiscard]
```

Definition at line 51 of file [Gui.hpp](#).

References [m_state](#).

Referenced by [ven::EventManager::handleEvents\(\)](#).

Here is the caller graph for this function:



7.19.3.7 init()

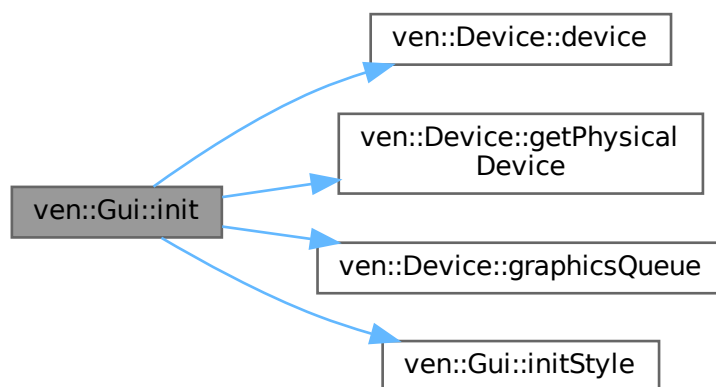
```
void ven::Gui::init (
    GLFWwindow * window,
    VkInstance instance,
    const Device * device,
    VkRenderPass renderPass)
```

Definition at line 6 of file [init.cpp](#).

References [ven::DESCRIPTOR_COUNT](#), [ven::Device::device\(\)](#), [ven::Device::getPhysicalDevice\(\)](#), [ven::Device::graphicsQueue\(\)](#), [initStyle\(\)](#), and [m_io](#).

Referenced by [ven::Engine::Engine\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



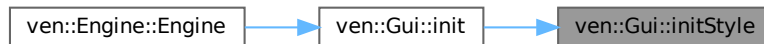
7.19.3.8 initStyle()

```
void ven::Gui::initStyle () [static], [private]
```

Definition at line 54 of file [init.cpp](#).

Referenced by [init\(\)](#).

Here is the caller graph for this function:



7.19.3.9 inputsSection()

```
void ven::Gui::inputsSection (
    const ImGuiIO & io) [static], [private]
```

Definition at line 280 of file [render.cpp](#).

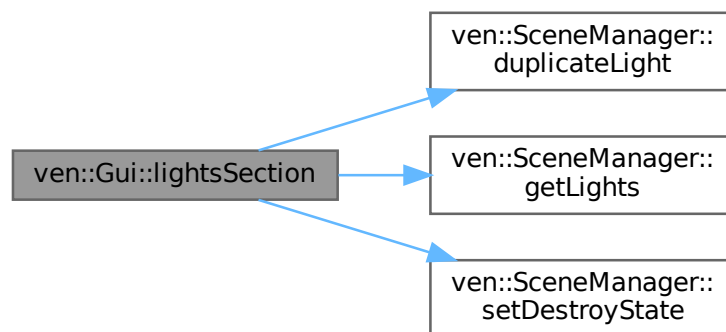
7.19.3.10 lightsSection()

```
void ven::Gui::lightsSection (
    SceneManager & sceneManager) [private]
```

Definition at line 183 of file [render.cpp](#).

References [ven::Colors::COLOR_PRESETS_3](#), [ven::DEFAULT_LIGHT_INTENSITY](#), [ven::DEFAULT_SHININESS](#), [ven::SceneManager::duplicateLight\(\)](#), [ven::SceneManager::getLights\(\)](#), and [ven::SceneManager::setDestroyState\(\)](#).

Here is the call graph for this function:



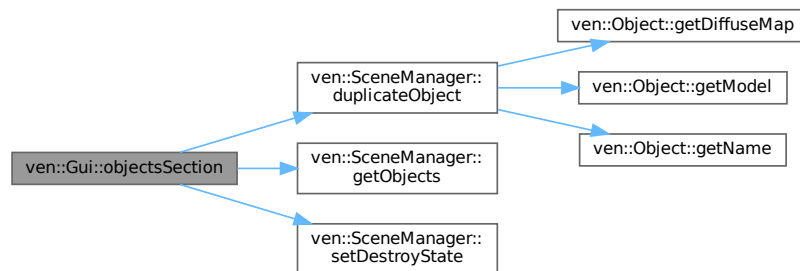
7.19.3.11 objectsSection()

```
void ven::Gui::objectsSection (
    SceneManager & sceneManager) [private]
```

Definition at line 156 of file [render.cpp](#).

References [ven::SceneManager::duplicateObject\(\)](#), [ven::SceneManager::getObjects\(\)](#), [ven::Colors::GRAY_4](#), and [ven::SceneManager::setDestroyState\(\)](#).

Here is the call graph for this function:



7.19.3.12 operator=()

```
Gui & ven::Gui::operator= (
    const Gui & ) [delete]
```

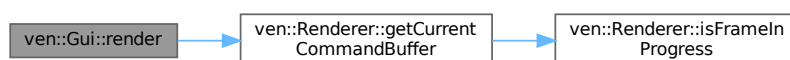
7.19.3.13 render()

```
void ven::Gui::render (
    Renderer * renderer,
    SceneManager & sceneManager,
    Camera & camera,
    VkPhysicalDevice physicalDevice,
    GlobalUbo & ubo,
    const ClockData & clockData)
```

Definition at line 16 of file [render.cpp](#).

References [ven::Renderer::getCurrentCommandBuffer\(\)](#).

Here is the call graph for this function:



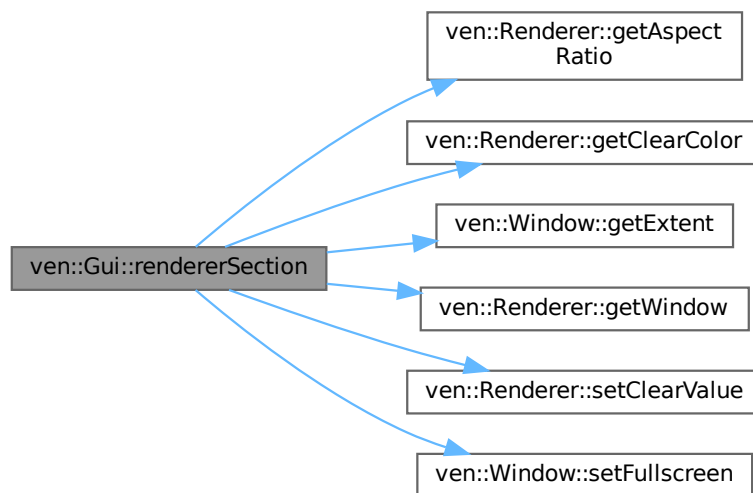
7.19.3.14 `rendererSection()`

```
void ven::Gui::rendererSection (
    Renderer * renderer,
    GlobalUbo & ubo) [static], [private]
```

Definition at line 46 of file [render.cpp](#).

References [ven::GlobalUbo::ambientLightColor](#), [ven::Colors::COLOR_PRESETS_4](#), [ven::Colors::COLOR_PRESETS_VK](#), [ven::DEFAULT_AMBIENT_LIGHT_INTENSITY](#), [ven::Renderer::getAspectRatio\(\)](#), [ven::Renderer::getClearColor\(\)](#), [ven::Window::getExtent\(\)](#), [ven::Renderer::getWindow\(\)](#), [ven::Renderer::setClearColor\(\)](#), and [ven::Window::setFullscreen\(\)](#).

Here is the call graph for this function:



7.19.3.15 `renderFrameWindow()`

```
void ven::Gui::renderFrameWindow (
    const ClockData & clockData) [static], [private]
```

Definition at line 37 of file [render.cpp](#).

References [ven::Gui::ClockData::deltaTimeMS](#), and [ven::Gui::ClockData::fps](#).

7.19.3.16 `setState()`

```
void ven::Gui::setState (
    const GUI_STATE state) [inline]
```

Definition at line 50 of file [Gui.hpp](#).

References [m_state](#).

Referenced by [ven::EventManager::handleEvents\(\)](#).

Here is the caller graph for this function:



7.19.4 Member Data Documentation

7.19.4.1 `m_intensity`

```
float ven::Gui::m_intensity {1.0F} [private]
```

Definition at line 70 of file [Gui.hpp](#).

7.19.4.2 `m_io`

```
ImGuiIO* ven::Gui::m_io {nullptr} [private]
```

Definition at line 68 of file [Gui.hpp](#).

Referenced by [init\(\)](#).

7.19.4.3 `m_lightsToRemove`

```
std::vector<unsigned int> ven::Gui::m_lightsToRemove [private]
```

Definition at line 74 of file [Gui.hpp](#).

Referenced by [getLightsToRemove\(\)](#).

7.19.4.4 `m_objectsToRemove`

```
std::vector<unsigned int> ven::Gui::m_objectsToRemove [private]
```

Definition at line 73 of file [Gui.hpp](#).

Referenced by [getObjectsToRemove\(\)](#).

7.19.4.5 m_shininess

```
float ven::Gui::m_shininess {DEFAULT_SHININESS} [private]
```

Definition at line 71 of file [Gui.hpp](#).

7.19.4.6 m_state

```
GUI_STATE ven::Gui::m_state {HIDDEN} [private]
```

Definition at line 69 of file [Gui.hpp](#).

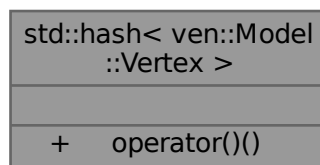
Referenced by [getState\(\)](#), and [setState\(\)](#).

The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/Gui.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Core/GUI/init.cpp](#)
- [/home/runner/work/VEngine/VEngine/src/Core/GUI/render.cpp](#)

7.20 std::hash< ven::Model::Vertex > Struct Reference

Collaboration diagram for `std::hash< ven::Model::Vertex >`:



Public Member Functions

- `size_t operator() (ven::Model::Vertex const &vertex) const noexcept`

7.20.1 Detailed Description

Definition at line 12 of file [model.cpp](#).

7.20.2 Member Function Documentation

7.20.2.1 operator()

```
size_t std::hash< ven::Model::Vertex >::operator() (  
    ven::Model::Vertex const & vertex) const    [inline], [noexcept]
```

Definition at line 13 of file [model.cpp](#).

References [ven::hashCombine\(\)](#).

Here is the call graph for this function:



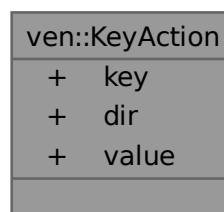
The documentation for this struct was generated from the following file:

- [/home/runner/work/VEngine/VEngine/src/Gfx/model.cpp](#)

7.21 ven::KeyAction Struct Reference

```
#include <EventManager.hpp>
```

Collaboration diagram for ven::KeyAction:



Public Attributes

- uint16_t [key](#)
- glm::vec3 * [dir](#)
- glm::vec3 [value](#)

7.21.1 Detailed Description

Definition at line 14 of file [EventManager.hpp](#).

7.21.2 Member Data Documentation

7.21.2.1 dir

```
glm::vec3* ven::KeyAction::dir
```

Definition at line 16 of file [EventManager.hpp](#).

7.21.2.2 key

```
uint16_t ven::KeyAction::key
```

Definition at line 15 of file [EventManager.hpp](#).

7.21.2.3 value

```
glm::vec3 ven::KeyAction::value
```

Definition at line 17 of file [EventManager.hpp](#).

The documentation for this struct was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/EventManager.hpp](#)

7.22 ven::KeyMappings Struct Reference

```
#include <EventManager.hpp>
```

Collaboration diagram for ven::KeyMappings:

ven::KeyMappings
+ moveLeft
+ moveRight
+ moveForward
+ moveBackward
+ moveUp
+ moveDown
+ lookLeft
+ lookRight
+ lookUp
+ lookDown
+ toggleGui

Public Attributes

- uint16_t [moveLeft](#) = GLFW_KEY_A
- uint16_t [moveRight](#) = GLFW_KEY_D
- uint16_t [moveForward](#) = GLFW_KEY_W
- uint16_t [moveBackward](#) = GLFW_KEY_S
- uint16_t [moveUp](#) = GLFW_KEY_SPACE
- uint16_t [moveDown](#) = GLFW_KEY_LEFT_SHIFT
- uint16_t [lookLeft](#) = GLFW_KEY_LEFT
- uint16_t [lookRight](#) = GLFW_KEY_RIGHT
- uint16_t [lookUp](#) = GLFW_KEY_UP
- uint16_t [lookDown](#) = GLFW_KEY_DOWN
- uint16_t [toggleGui](#) = GLFW_KEY_0

7.22.1 Detailed Description

Definition at line 20 of file [EventManager.hpp](#).

7.22.2 Member Data Documentation

7.22.2.1 lookDown

```
uint16_t ven::KeyMappings::lookDown = GLFW_KEY_DOWN
```

Definition at line 30 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

7.22.2.2 lookLeft

```
uint16_t ven::KeyMappings::lookLeft = GLFW_KEY_LEFT
```

Definition at line 27 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

7.22.2.3 lookRight

```
uint16_t ven::KeyMappings::lookRight = GLFW_KEY_RIGHT
```

Definition at line 28 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

7.22.2.4 lookUp

```
uint16_t ven::KeyMappings::lookUp = GLFW_KEY_UP
```

Definition at line 29 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

7.22.2.5 moveBackward

```
uint16_t ven::KeyMappings::moveBackward = GLFW_KEY_S
```

Definition at line 24 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

7.22.2.6 moveDown

```
uint16_t ven::KeyMappings::moveDown = GLFW_KEY_LEFT_SHIFT
```

Definition at line 26 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

7.22.2.7 moveForward

```
uint16_t ven::KeyMappings::moveForward = GLFW_KEY_W
```

Definition at line 23 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

7.22.2.8 moveLeft

```
uint16_t ven::KeyMappings::moveLeft = GLFW_KEY_A
```

Definition at line 21 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

7.22.2.9 moveRight

```
uint16_t ven::KeyMappings::moveRight = GLFW_KEY_D
```

Definition at line 22 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

7.22.2.10 moveUp

```
uint16_t ven::KeyMappings::moveUp = GLFW_KEY_SPACE
```

Definition at line 25 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::moveCamera\(\)](#).

7.22.2.11 toggleGui

```
uint16_t ven::KeyMappings::toggleGui = GLFW_KEY_0
```

Definition at line 31 of file [EventManager.hpp](#).

Referenced by [ven::EventManager::handleEvents\(\)](#).

The documentation for this struct was generated from the following file:

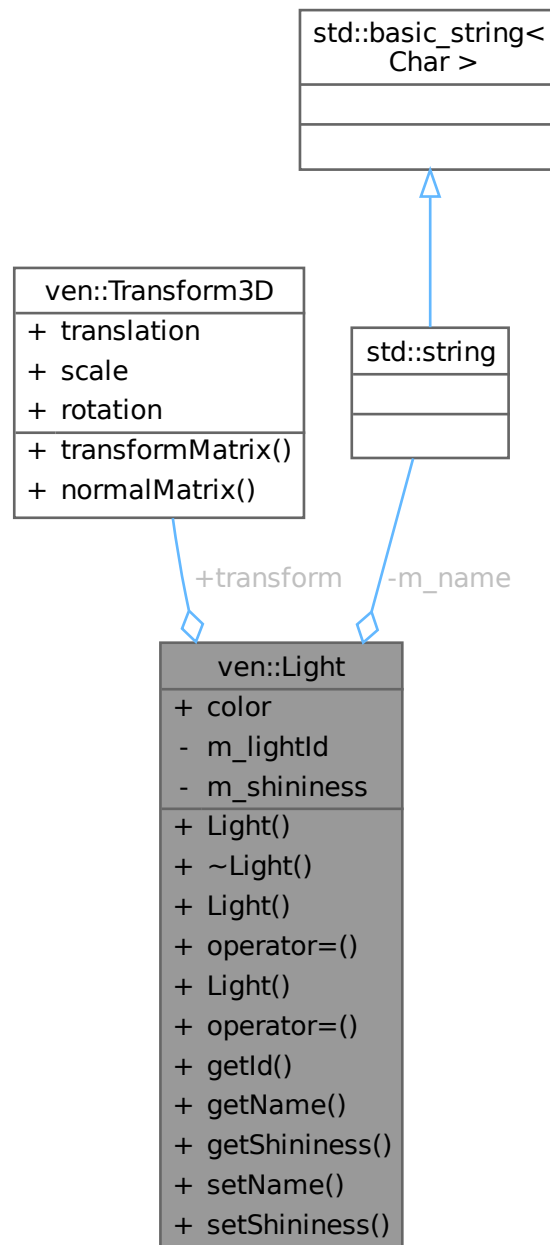
- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/EventManager.hpp](#)

7.23 ven::Light Class Reference

Class for light.

```
#include <Light.hpp>
```

Collaboration diagram for ven::Light:



Public Types

- using `Map` = `std::unordered_map<unsigned int, Light>`

Public Member Functions

- [Light](#) (const unsigned int objId)
- [~Light](#) ()=default
- [Light](#) (const [Light](#) &)=delete
- [Light](#) & [operator=](#) (const [Light](#) &)=delete
- [Light](#) ([Light](#) &&)=default
- [Light](#) & [operator=](#) ([Light](#) &&)=default
- unsigned int [getId](#) () const
- std::string [getName](#) () const
- float [getShininess](#) () const
- void [setName](#) (const std::string &name)
- void [setShininess](#) (const float shininess)

Public Attributes

- glm::vec4 [color](#) {DEFAULT_LIGHT_COLOR}
- [Transform3D](#) [transform](#) {}

Private Attributes

- unsigned int [m_lightId](#)
- std::string [m_name](#) {"point light"}
- float [m_shininess](#) {DEFAULT_SHININESS}

7.23.1 Detailed Description

Class for light.

Definition at line 25 of file [Light.hpp](#).

7.23.2 Member Typedef Documentation

7.23.2.1 Map

```
using ven::Light::Map = std::unordered_map<unsigned int, Light>
```

Definition at line 29 of file [Light.hpp](#).

7.23.3 Constructor & Destructor Documentation

7.23.3.1 Light() [1/3]

```
ven::Light::Light (
    const unsigned int objId) [inline], [explicit]
```

Definition at line 31 of file [Light.hpp](#).

7.23.3.2 ~Light()

```
ven::Light::~~Light () [default]
```

7.23.3.3 Light() [2/3]

```
ven::Light::Light (  
    const Light & ) [delete]
```

7.23.3.4 Light() [3/3]

```
ven::Light::Light (  
    Light && ) [default]
```

7.23.4 Member Function Documentation

7.23.4.1 getId()

```
unsigned int ven::Light::getId () const [inline], [nodiscard]
```

Definition at line 40 of file [Light.hpp](#).

References [m_lightId](#).

Referenced by [ven::SceneManager::createLight\(\)](#).

Here is the caller graph for this function:



7.23.4.2 getName()

```
std::string ven::Light::getName () const [inline], [nodiscard]
```

Definition at line 41 of file [Light.hpp](#).

References [m_name](#).

7.23.4.3 getShininess()

```
float ven::Light::getShininess () const [inline], [nodiscard]
```

Definition at line 42 of file [Light.hpp](#).

References [m_shininess](#).

7.23.4.4 operator=() [1/2]

```
Light & ven::Light::operator= (  
    const Light & ) [delete]
```

7.23.4.5 operator=() [2/2]

```
Light & ven::Light::operator= (  
    Light && ) [default]
```

7.23.4.6 setName()

```
void ven::Light::setName (  
    const std::string & name) [inline]
```

Definition at line 44 of file [Light.hpp](#).

References [m_name](#).

7.23.4.7 setShininess()

```
void ven::Light::setShininess (  
    const float shininess) [inline]
```

Definition at line 45 of file [Light.hpp](#).

References [m_shininess](#).

7.23.5 Member Data Documentation

7.23.5.1 color

```
glm::vec4 ven::Light::color {DEFAULT_LIGHT_COLOR}
```

Definition at line 47 of file [Light.hpp](#).

Referenced by [ven::SceneManager::createLight\(\)](#), and [ven::SceneManager::duplicateLight\(\)](#).

7.23.5.2 m_lightId

`unsigned int ven::Light::m_lightId [private]`

Definition at line 52 of file [Light.hpp](#).

Referenced by [getId\(\)](#).

7.23.5.3 m_name

`std::string ven::Light::m_name {"point light"} [private]`

Definition at line 53 of file [Light.hpp](#).

Referenced by [getName\(\)](#), and [setName\(\)](#).

7.23.5.4 m_shininess

`float ven::Light::m_shininess {DEFAULT_SHININESS} [private]`

Definition at line 54 of file [Light.hpp](#).

Referenced by [getShininess\(\)](#), and [setShininess\(\)](#).

7.23.5.5 transform

`Transform3D ven::Light::transform {}`

Definition at line 48 of file [Light.hpp](#).

Referenced by [ven::SceneManager::createLight\(\)](#), and [ven::SceneManager::duplicateLight\(\)](#).

The documentation for this class was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Scene/Entities/Light.hpp](#)

7.24 ven::LightPushConstantData Struct Reference

`#include <PointLight.hpp>`

Collaboration diagram for `ven::LightPushConstantData`:

ven::LightPushConstantData	
+	position
+	color
+	radius

Public Attributes

- glm::vec4 [position](#) {}
- glm::vec4 [color](#) {}
- float [radius](#)

7.24.1 Detailed Description

Definition at line 13 of file [PointLight.hpp](#).

7.24.2 Member Data Documentation

7.24.2.1 color

```
glm::vec4 ven::LightPushConstantData::color {}
```

Definition at line 15 of file [PointLight.hpp](#).

7.24.2.2 position

```
glm::vec4 ven::LightPushConstantData::position {}
```

Definition at line 14 of file [PointLight.hpp](#).

Referenced by [ven::PointLightRenderSystem::render\(\)](#).

7.24.2.3 radius

```
float ven::LightPushConstantData::radius
```

Definition at line 16 of file [PointLight.hpp](#).

The documentation for this struct was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/PointLight.hpp](#)

Public Member Functions

- [Model](#) ([Device](#) &device, const [Builder](#) &builder)
- [~Model](#) ()=default
- [Model](#) (const [Model](#) &)=delete
- void [operator=](#) (const [Model](#) &)=delete
- void [bind](#) (VkCommandBuffer commandBuffer) const
- void [draw](#) (VkCommandBuffer commandBuffer) const

Static Public Member Functions

- static std::unique_ptr< [Model](#) > [createModelFromFile](#) ([Device](#) &device, const std::string &filename)

Private Member Functions

- void [createVertexBuffer](#) (const std::vector< [Vertex](#) > &vertices)
- void [createIndexBuffer](#) (const std::vector< uint32_t > &indices)

Private Attributes

- [Device](#) & [m_device](#)
- std::unique_ptr< [Buffer](#) > [m_vertexBuffer](#)
- uint32_t [m_vertexCount](#)
- bool [m_hasIndexBuffer](#) {false}
- std::unique_ptr< [Buffer](#) > [m_indexBuffer](#)
- uint32_t [m_indexCount](#)

7.25.1 Detailed Description

Class for model.

Definition at line 24 of file [Model.hpp](#).

7.25.2 Constructor & Destructor Documentation

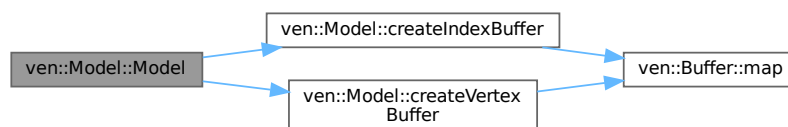
7.25.2.1 Model() [1/2]

```
ven::Model::Model (
    Device & device,
    const Builder & builder)
```

Definition at line 20 of file [model.cpp](#).

References [createIndexBuffer\(\)](#), [createVertexBuffer\(\)](#), [ven::Model::Builder::indices](#), and [ven::Model::Builder::vertices](#).

Here is the call graph for this function:



7.25.2.2 ~Model()

```
ven::Model::~~Model () [default]
```

7.25.2.3 Model() [2/2]

```
ven::Model::Model (  
    const Model & ) [delete]
```

7.25.3 Member Function Documentation

7.25.3.1 bind()

```
void ven::Model::bind (  
    VkCommandBuffer commandBuffer) const
```

Definition at line 73 of file [model.cpp](#).

7.25.3.2 createIndexBuffer()

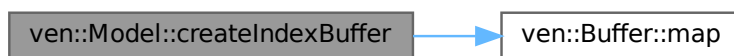
```
void ven::Model::createIndexBuffer (  
    const std::vector< uint32_t > & indices) [private]
```

Definition at line 43 of file [model.cpp](#).

References [ven::Buffer::map\(\)](#).

Referenced by [Model\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.25.3.3 createModelFromFile()

```
std::unique_ptr< ven::Model > ven::Model::createModelFromFile (
    Device & device,
    const std::string & filename) [static]
```

Definition at line 84 of file [model.cpp](#).

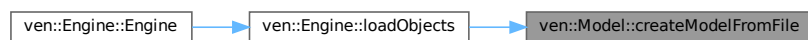
References [ven::Model::Builder::loadModel\(\)](#).

Referenced by [ven::Engine::loadObjects\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.25.3.4 createVertexBuffer()

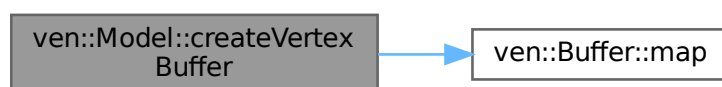
```
void ven::Model::createVertexBuffer (
    const std::vector< Vertex > & vertices) [private]
```

Definition at line 26 of file [model.cpp](#).

References [ven::Buffer::map\(\)](#).

Referenced by [Model\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.25.3.5 draw()

```
void ven::Model::draw (
    VkCommandBuffer commandBuffer) const
```

Definition at line 64 of file [model.cpp](#).

7.25.3.6 operator=()

```
void ven::Model::operator= (
    const Model & ) [delete]
```

7.25.4 Member Data Documentation

7.25.4.1 m_device

```
Device& ven::Model::m_device [private]
```

Definition at line 67 of file [Model.hpp](#).

7.25.4.2 m_hasIndexBuffer

```
bool ven::Model::m_hasIndexBuffer {false} [private]
```

Definition at line 71 of file [Model.hpp](#).

7.25.4.3 m_indexBuffer

```
std::unique_ptr<Buffer> ven::Model::m_indexBuffer [private]
```

Definition at line 72 of file [Model.hpp](#).

7.25.4.4 m_indexCount

```
uint32_t ven::Model::m_indexCount [private]
```

Definition at line 73 of file [Model.hpp](#).

7.25.4.5 m_vertexBuffer

```
std::unique_ptr<Buffer> ven::Model::m_vertexBuffer [private]
```

Definition at line 68 of file [Model.hpp](#).

7.25.4.6 m_vertexCount

```
uint32_t ven::Model::m_vertexCount [private]
```

Definition at line 69 of file [Model.hpp](#).

The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Model.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/model.cpp](#)

7.26 ven::Object Class Reference

Class for object.

```
#include <Object.hpp>
```


- `~Object()`=default
- `Object(const Object &)=delete`
- `Object & operator= (const Object &)=delete`
- `Object(Object &&)=default`
- `Object & operator= (Object &&)=default`
- unsigned int `getId()` const
- std::string `getName()` const
- std::shared_ptr< [Model](#) > `getModel()` const
- std::shared_ptr< [Texture](#) > `getDiffuseMap()` const
- VkDescriptorBufferInfo `getBufferInfo` (const int frameIndex) const
- void `setModel` (const std::shared_ptr< [Model](#) > &model)
- void `setDiffuseMap` (const std::shared_ptr< [Texture](#) > &diffuseMap)
- void `setName` (const std::string &name)
- void `setBufferInfo` (const int frameIndex, const VkDescriptorBufferInfo &info)

Public Attributes

- [Transform3D](#) `transform` {}

Private Attributes

- unsigned int `m_objId`
- std::string `m_name`
- std::shared_ptr< [Model](#) > `m_model` = nullptr
- std::shared_ptr< [Texture](#) > `m_diffuseMap` = nullptr
- std::unordered_map< int, VkDescriptorBufferInfo > `m_bufferInfo`

7.26.1 Detailed Description

Class for object.

Definition at line 24 of file [Object.hpp](#).

7.26.2 Member Typedef Documentation

7.26.2.1 Map

```
using ven::Object::Map = std::unordered_map<unsigned int, Object>
```

Definition at line 28 of file [Object.hpp](#).

7.26.3 Constructor & Destructor Documentation

7.26.3.1 Object() [1/3]

```
ven::Object::Object (
    const unsigned int objId) [inline], [explicit]
```

Definition at line 30 of file [Object.hpp](#).

7.26.3.2 ~Object()

```
ven::Object::~~Object () [default]
```

7.26.3.3 Object() [2/3]

```
ven::Object::Object (
    const Object & ) [delete]
```

7.26.3.4 Object() [3/3]

```
ven::Object::Object (
    Object && ) [default]
```

7.26.4 Member Function Documentation

7.26.4.1 getBufferInfo()

```
VkDescriptorBufferInfo ven::Object::getBufferInfo (
    const int frameIndex) const [inline], [nodiscard]
```

Definition at line 43 of file [Object.hpp](#).

References [m_bufferInfo](#).

7.26.4.2 getDiffuseMap()

```
std::shared_ptr< Texture > ven::Object::getDiffuseMap () const [inline], [nodiscard]
```

Definition at line 42 of file [Object.hpp](#).

References [m_diffuseMap](#).

Referenced by [ven::SceneManager::duplicateObject\(\)](#).

Here is the caller graph for this function:



7.26.4.3 getId()

```
unsigned int ven::Object::getId () const [inline], [nodiscard]
```

Definition at line 39 of file [Object.hpp](#).

References [m_objId](#).

7.26.4.4 getModel()

```
std::shared_ptr< Model > ven::Object::getModel () const [inline], [nodiscard]
```

Definition at line 41 of file [Object.hpp](#).

References [m_model](#).

Referenced by [ven::SceneManager::duplicateObject\(\)](#).

Here is the caller graph for this function:



7.26.4.5 getName()

```
std::string ven::Object::getName () const [inline], [nodiscard]
```

Definition at line 40 of file [Object.hpp](#).

References [m_name](#).

Referenced by [ven::SceneManager::duplicateObject\(\)](#).

Here is the caller graph for this function:



7.26.4.6 operator=() [1/2]

```
Object & ven::Object::operator= (  
    const Object & ) [delete]
```

7.26.4.7 operator=() [2/2]

```
Object & ven::Object::operator= (  
    Object && ) [default]
```

7.26.4.8 setBufferInfo()

```
void ven::Object::setBufferInfo (  
    const int frameIndex,  
    const VkDescriptorBufferInfo & info) [inline]
```

Definition at line 47 of file [Object.hpp](#).

References [m_bufferInfo](#).

7.26.4.9 setDiffuseMap()

```
void ven::Object::setDiffuseMap (  
    const std::shared_ptr< Texture > & diffuseMap) [inline]
```

Definition at line 45 of file [Object.hpp](#).

References [m_diffuseMap](#).

7.26.4.10 setModel()

```
void ven::Object::setModel (  
    const std::shared_ptr< Model > & model) [inline]
```

Definition at line 44 of file [Object.hpp](#).

References [m_model](#).

7.26.4.11 setName()

```
void ven::Object::setName (  
    const std::string & name) [inline]
```

Definition at line 46 of file [Object.hpp](#).

References [m_name](#).

7.26.5 Member Data Documentation

7.26.5.1 m_bufferInfo

```
std::unordered_map<int, VkDescriptorBufferInfo> ven::Object::m_bufferInfo [private]
```

Definition at line 59 of file [Object.hpp](#).

Referenced by [getBufferInfo\(\)](#), and [setBufferInfo\(\)](#).

7.26.5.2 m_diffuseMap

```
std::shared_ptr<Texture> ven::Object::m_diffuseMap = nullptr [private]
```

Definition at line 58 of file [Object.hpp](#).

Referenced by [getDiffuseMap\(\)](#), and [setDiffuseMap\(\)](#).

7.26.5.3 m_model

```
std::shared_ptr<Model> ven::Object::m_model = nullptr [private]
```

Definition at line 57 of file [Object.hpp](#).

Referenced by [getModel\(\)](#), and [setModel\(\)](#).

7.26.5.4 m_name

```
std::string ven::Object::m_name [private]
```

Definition at line 56 of file [Object.hpp](#).

Referenced by [getName\(\)](#), and [setName\(\)](#).

7.26.5.5 m_objId

```
unsigned int ven::Object::m_objId [private]
```

Definition at line 55 of file [Object.hpp](#).

Referenced by [getId\(\)](#).

7.26.5.6 transform

```
Transform3D ven::Object::transform {}
```

Definition at line 51 of file [Object.hpp](#).

Referenced by [ven::SceneManager::duplicateObject\(\)](#).

The documentation for this class was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Scene/Entities/Object.hpp](#)

7.27 ven::ObjectBufferData Struct Reference

```
#include <FrameInfo.hpp>
```

Collaboration diagram for ven::ObjectBufferData:

ven::ObjectBufferData
+ modelMatrix
+ normalMatrix

Public Attributes

- glm::mat4 [modelMatrix](#) {1.F}
- glm::mat4 [normalMatrix](#) {1.F}

7.27.1 Detailed Description

Definition at line 29 of file [FrameInfo.hpp](#).

7.27.2 Member Data Documentation

7.27.2.1 modelMatrix

```
glm::mat4 ven::ObjectBufferData::modelMatrix {1.F}
```

Definition at line 30 of file [FrameInfo.hpp](#).

Referenced by [ven::SceneManager::updateBuffer\(\)](#).

7.27.2.2 normalMatrix

```
glm::mat4 ven::ObjectBufferData::normalMatrix {1.F}
```

Definition at line 31 of file [FrameInfo.hpp](#).

The documentation for this struct was generated from the following file:

- /home/runner/work/VEngine/VEngine/include/VEngine/Core/[FrameInfo.hpp](#)

7.28 ven::ObjectPushConstantData Struct Reference

```
#include <Object.hpp>
```

Collaboration diagram for ven::ObjectPushConstantData:

ven::ObjectPushConstantData	
+	modelMatrix
+	normalMatrix

Public Attributes

- glm::mat4 [modelMatrix](#) {}
- glm::mat4 [normalMatrix](#) {}

7.28.1 Detailed Description

Definition at line 13 of file [Object.hpp](#).

7.28.2 Member Data Documentation

7.28.2.1 modelMatrix

```
glm::mat4 ven::ObjectPushConstantData::modelMatrix {}
```

Definition at line 14 of file [Object.hpp](#).

Referenced by [ven::ObjectRenderSystem::render\(\)](#).

7.28.2.2 normalMatrix

```
glm::mat4 ven::ObjectPushConstantData::normalMatrix {}
```

Definition at line 15 of file [Object.hpp](#).

The documentation for this struct was generated from the following file:

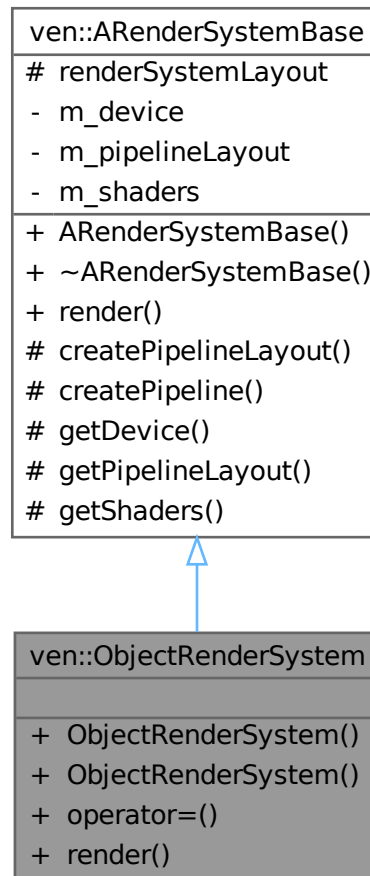
- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/Object.hpp](#)

7.29 ven::ObjectRenderSystem Class Reference

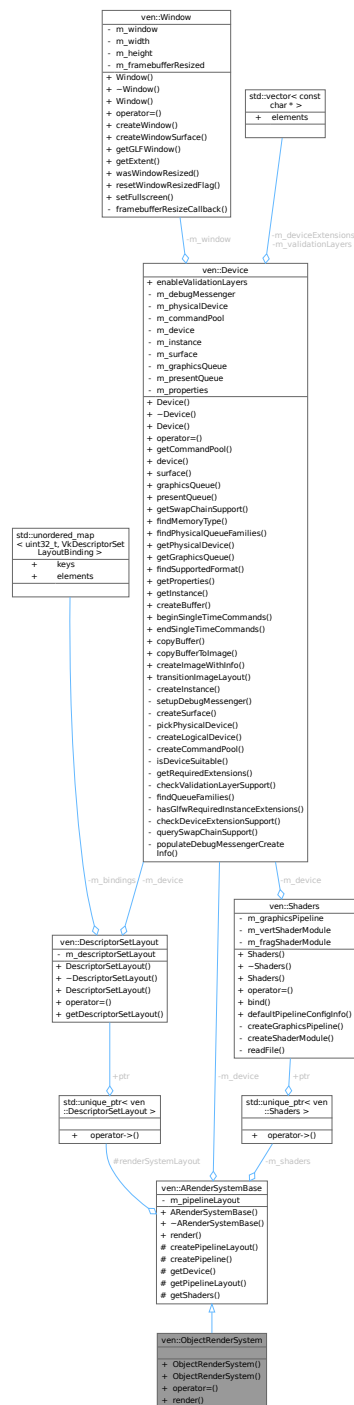
Class for object render system.

```
#include <Object.hpp>
```

Inheritance diagram for ven::ObjectRenderSystem:



Collaboration diagram for ven::ObjectRenderSystem:



Public Member Functions

- [ObjectRenderSystem](#) ([Device](#) &device, const [VkRenderPass](#) renderPass, const [VkDescriptorSetLayout](#) globalSetLayout)
- [ObjectRenderSystem](#) (const [ObjectRenderSystem](#) &)=delete
- [ObjectRenderSystem](#) & operator= (const [ObjectRenderSystem](#) &)=delete
- void [render](#) (const [FrameInfo](#) &frameInfo) const override

Public Member Functions inherited from [ven::ARenderSystemBase](#)

- [ARenderSystemBase](#) ([Device](#) &device)
- virtual [~ARenderSystemBase](#) ()

Additional Inherited Members

Protected Member Functions inherited from [ven::ARenderSystemBase](#)

- void [createPipelineLayout](#) (VkDescriptorSetLayout globalSetLayout, uint32_t pushConstantSize)
- void [createPipeline](#) (VkRenderPass renderPass, const std::string &shadersVertPath, const std::string &shadersFragPath, bool isLight)
- [Device](#) & [getDevice](#) () const
- VkPipelineLayout [getPipelineLayout](#) () const
- const std::unique_ptr< [Shaders](#) > & [getShaders](#) () const

Protected Attributes inherited from [ven::ARenderSystemBase](#)

- std::unique_ptr< [DescriptorSetLayout](#) > [renderSystemLayout](#)

7.29.1 Detailed Description

Class for object render system.

Definition at line 23 of file [Object.hpp](#).

7.29.2 Constructor & Destructor Documentation

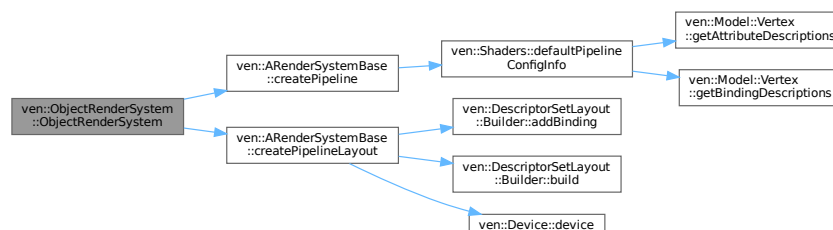
7.29.2.1 ObjectRenderSystem() [1/2]

```
ven::ObjectRenderSystem::ObjectRenderSystem (
    Device & device,
    const VkRenderPass renderPass,
    const VkDescriptorSetLayout globalSetLayout) [inline], [explicit]
```

Definition at line 27 of file [Object.hpp](#).

References [ven::ARenderSystemBase::createPipeline\(\)](#), [ven::ARenderSystemBase::createPipelineLayout\(\)](#), and [ven::SHADERS_BIN_PATH](#).

Here is the call graph for this function:



7.29.2.2 ObjectRenderSystem() [2/2]

```
ven::ObjectRenderSystem::ObjectRenderSystem (
    const ObjectRenderSystem & ) [delete]
```

7.29.3 Member Function Documentation

7.29.3.1 operator=()

```
ObjectRenderSystem & ven::ObjectRenderSystem::operator= (
    const ObjectRenderSystem & ) [delete]
```

7.29.3.2 render()

```
void ven::ObjectRenderSystem::render (
    const FrameInfo & frameInfo) const [override], [virtual]
```

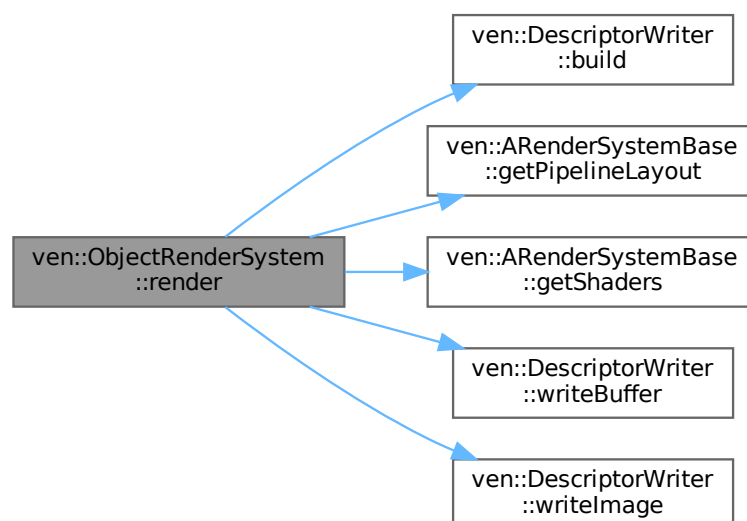
Implements [ven::ARenderSystemBase](#).

Definition at line 6 of file [object.cpp](#).

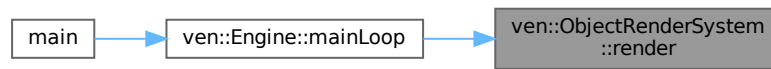
References [ven::DescriptorWriter::build\(\)](#), [ven::FrameInfo::commandBuffer](#), [ven::FrameInfo::frameDescriptorPool](#), [ven::FrameInfo::frameIndex](#), [ven::ARenderSystemBase::getPipelineLayout\(\)](#), [ven::ARenderSystemBase::getShaders\(\)](#), [ven::FrameInfo::globalDescriptorSet](#), [ven::ObjectPushConstantData::modelMatrix](#), [ven::FrameInfo::objects](#), [ven::ARenderSystemBase::renderSystemLayout](#), [ven::DescriptorWriter::writeBuffer\(\)](#), and [ven::DescriptorWriter::writeImage\(\)](#).

Referenced by [ven::Engine::mainLoop\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



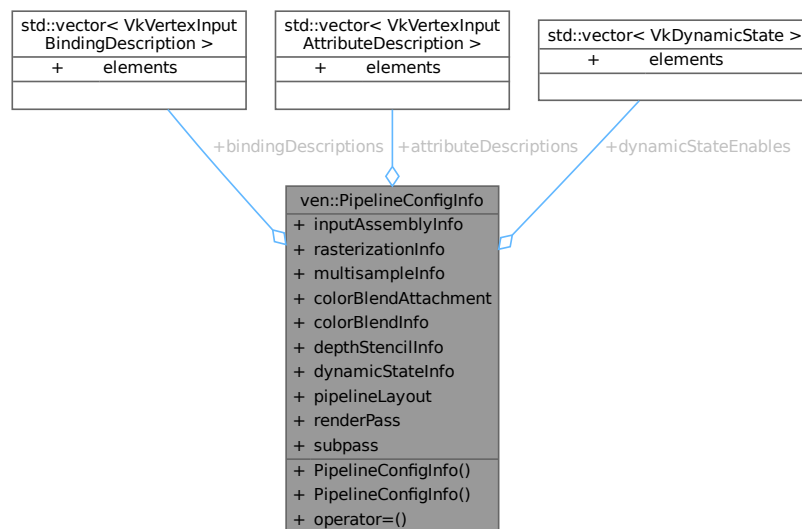
The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/Object.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Core/RenderSystems/object.cpp](#)

7.30 ven::PipelineConfigInfo Struct Reference

```
#include <Shaders.hpp>
```

Collaboration diagram for ven::PipelineConfigInfo:



Public Member Functions

- [PipelineConfigInfo](#) ()=default
- [PipelineConfigInfo](#) (const [PipelineConfigInfo](#) &)=delete
- [PipelineConfigInfo](#) & [operator=](#) (const [PipelineConfigInfo](#) &)=delete

Public Attributes

- `std::vector< VkVertexInputBindingDescription >` [bindingDescriptions](#)
- `std::vector< VkVertexInputAttributeDescription >` [attributeDescriptions](#)
- `VkPipelineInputAssemblyStateCreateInfo` [inputAssemblyInfo](#) {}
- `VkPipelineRasterizationStateCreateInfo` [rasterizationInfo](#) {}
- `VkPipelineMultisampleStateCreateInfo` [multisampleInfo](#) {}
- `VkPipelineColorBlendAttachmentState` [colorBlendAttachment](#) {}
- `VkPipelineColorBlendStateCreateInfo` [colorBlendInfo](#) {}
- `VkPipelineDepthStencilStateCreateInfo` [depthStencilInfo](#) {}
- `std::vector< VkDynamicState >` [dynamicStateEnables](#)
- `VkPipelineDynamicStateCreateInfo` [dynamicStateInfo](#) {}
- `VkPipelineLayout` [pipelineLayout](#) = nullptr
- `VkRenderPass` [renderPass](#) = nullptr
- `uint32_t` [subpass](#) = 0

7.30.1 Detailed Description

Definition at line 15 of file [Shaders.hpp](#).

7.30.2 Constructor & Destructor Documentation

7.30.2.1 PipelineConfigInfo() [1/2]

```
ven::PipelineConfigInfo::PipelineConfigInfo () [default]
```

7.30.2.2 PipelineConfigInfo() [2/2]

```
ven::PipelineConfigInfo::PipelineConfigInfo (
    const PipelineConfigInfo & ) [delete]
```

7.30.3 Member Function Documentation

7.30.3.1 operator=()

```
PipelineConfigInfo & ven::PipelineConfigInfo::operator= (
    const PipelineConfigInfo & ) [delete]
```

7.30.4 Member Data Documentation

7.30.4.1 attributeDescriptions

```
std::vector<VkVertexInputAttributeDescription> ven::PipelineConfigInfo::attributeDescriptions
```

Definition at line 21 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#), and [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

7.30.4.2 bindingDescriptions

```
std::vector<VkVertexInputBindingDescription> ven::PipelineConfigInfo::bindingDescriptions
```

Definition at line 20 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#), and [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

7.30.4.3 colorBlendAttachment

```
VkPipelineColorBlendAttachmentState ven::PipelineConfigInfo::colorBlendAttachment {}
```

Definition at line 25 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

7.30.4.4 colorBlendInfo

```
VkPipelineColorBlendStateCreateInfo ven::PipelineConfigInfo::colorBlendInfo {}
```

Definition at line 26 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#), and [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

7.30.4.5 depthStencilInfo

```
VkPipelineDepthStencilStateCreateInfo ven::PipelineConfigInfo::depthStencilInfo {}
```

Definition at line 27 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#), and [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

7.30.4.6 dynamicStateEnables

```
std::vector<VkDynamicState> ven::PipelineConfigInfo::dynamicStateEnables
```

Definition at line 28 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

7.30.4.7 dynamicStateInfo

```
VkPipelineDynamicStateCreateInfo ven::PipelineConfigInfo::dynamicStateInfo {}
```

Definition at line 29 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#), and [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

7.30.4.8 inputAssemblyInfo

```
VkPipelineInputAssemblyStateCreateInfo ven::PipelineConfigInfo::inputAssemblyInfo {}
```

Definition at line 22 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#), and [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

7.30.4.9 multisampleInfo

```
VkPipelineMultisampleStateCreateInfo ven::PipelineConfigInfo::multisampleInfo {}
```

Definition at line 24 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#), and [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

7.30.4.10 pipelineLayout

```
VkPipelineLayout ven::PipelineConfigInfo::pipelineLayout = nullptr
```

Definition at line 30 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#).

7.30.4.11 rasterizationInfo

```
VkPipelineRasterizationStateCreateInfo ven::PipelineConfigInfo::rasterizationInfo {}
```

Definition at line 23 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#), and [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

7.30.4.12 renderPass

```
VkRenderPass ven::PipelineConfigInfo::renderPass = nullptr
```

Definition at line 31 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#).

7.30.4.13 subpass

```
uint32_t ven::PipelineConfigInfo::subpass = 0
```

Definition at line 32 of file [Shaders.hpp](#).

Referenced by [ven::Shaders::createGraphicsPipeline\(\)](#).

The documentation for this struct was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Shaders.hpp](#)

7.31 ven::PointLightData Struct Reference

```
#include <FrameInfo.hpp>
```

Collaboration diagram for ven::PointLightData:

ven::PointLightData
<div>+ position</div> <div>+ color</div> <div>+ shininess</div> <div>+ padding</div>

Public Attributes

- glm::vec4 [position](#) {}
- glm::vec4 [color](#) {}
- float [shininess](#) {32.F}
- float [padding](#) [3]

7.31.1 Detailed Description

Definition at line 21 of file [FrameInfo.hpp](#).

7.31.2 Member Data Documentation

7.31.2.1 color

```
glm::vec4 ven::PointLightData::color {}
```

Definition at line 24 of file [FrameInfo.hpp](#).

7.31.2.2 padding

```
float ven::PointLightData::padding[3]
```

Definition at line 26 of file [FrameInfo.hpp](#).

7.31.2.3 position

```
glm::vec4 ven::PointLightData::position {}
```

Definition at line 23 of file [FrameInfo.hpp](#).

7.31.2.4 shininess

```
float ven::PointLightData::shininess {32.F}
```

Definition at line 25 of file [FrameInfo.hpp](#).

The documentation for this struct was generated from the following file:

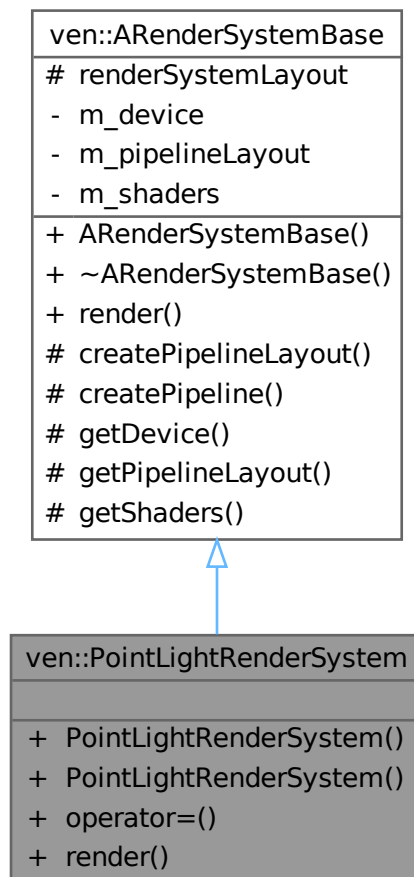
- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/FrameInfo.hpp](#)

7.32 ven::PointLightRenderSystem Class Reference

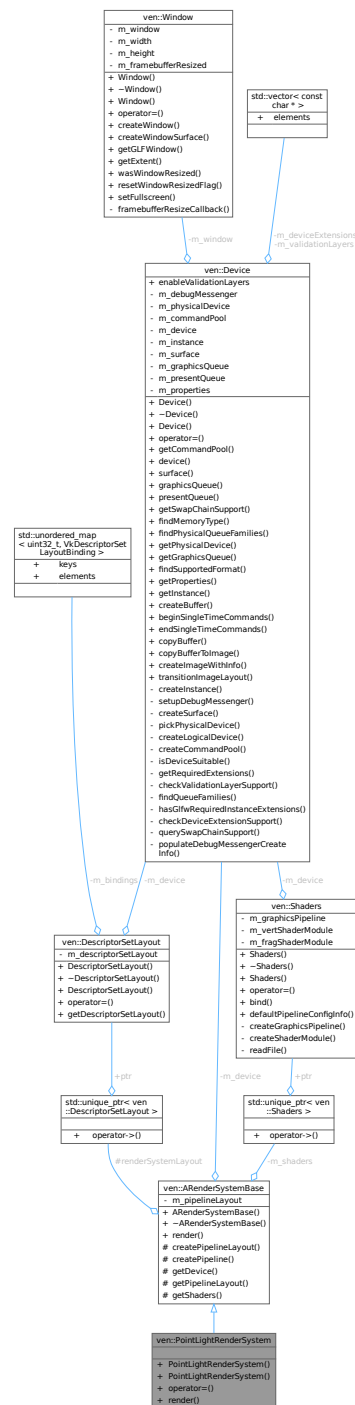
Class for point light system.

```
#include <PointLight.hpp>
```

Inheritance diagram for ven::PointLightRenderSystem:



Collaboration diagram for `ven::PointLightRenderSystem`:



Public Member Functions

- [PointLightRenderSystem](#) ([Device](#) &device, const [VkRenderPass](#) renderPass, const [VkDescriptorSetLayout](#) globalSetLayout)
- [PointLightRenderSystem](#) (const [PointLightRenderSystem](#) &)=delete
- [PointLightRenderSystem](#) & operator= (const [PointLightRenderSystem](#) &)=delete
- void [render](#) (const [FrameInfo](#) &frameInfo) const override

Public Member Functions inherited from [ven::ARenderSystemBase](#)

- [ARenderSystemBase](#) ([Device](#) &device)
- virtual [~ARenderSystemBase](#) ()

Additional Inherited Members

Protected Member Functions inherited from [ven::ARenderSystemBase](#)

- void [createPipelineLayout](#) (VkDescriptorSetLayout globalSetLayout, uint32_t pushConstantSize)
- void [createPipeline](#) (VkRenderPass renderPass, const std::string &shadersVertPath, const std::string &shadersFragPath, bool isLight)
- [Device](#) & [getDevice](#) () const
- VkPipelineLayout [getPipelineLayout](#) () const
- const std::unique_ptr< [Shaders](#) > & [getShaders](#) () const

Protected Attributes inherited from [ven::ARenderSystemBase](#)

- std::unique_ptr< [DescriptorSetLayout](#) > [renderSystemLayout](#)

7.32.1 Detailed Description

Class for point light system.

Definition at line 24 of file [PointLight.hpp](#).

7.32.2 Constructor & Destructor Documentation

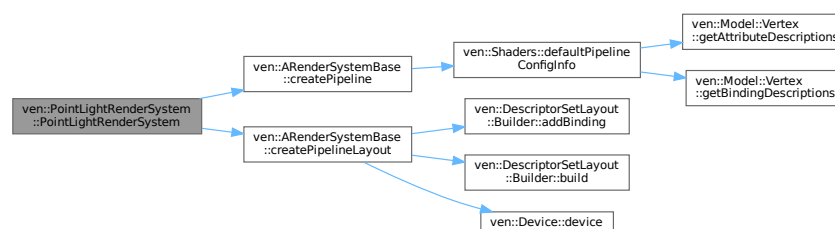
7.32.2.1 PointLightRenderSystem() [1/2]

```
ven::PointLightRenderSystem::PointLightRenderSystem (
    Device & device,
    const VkRenderPass renderPass,
    const VkDescriptorSetLayout globalSetLayout) [inline], [explicit]
```

Definition at line 28 of file [PointLight.hpp](#).

References [ven::ARenderSystemBase::createPipeline\(\)](#), [ven::ARenderSystemBase::createPipelineLayout\(\)](#), and [ven::SHADERS_BIN_PATH](#).

Here is the call graph for this function:



7.32.2.2 PointLightRenderSystem() [2/2]

```
ven::PointLightRenderSystem::PointLightRenderSystem (
    const PointLightRenderSystem & ) [delete]
```

7.32.3 Member Function Documentation

7.32.3.1 operator=()

```
PointLightRenderSystem & ven::PointLightRenderSystem::operator= (
    const PointLightRenderSystem & ) [delete]
```

7.32.3.2 render()

```
void ven::PointLightRenderSystem::render (
    const FrameInfo & frameInfo) const [override], [virtual]
```

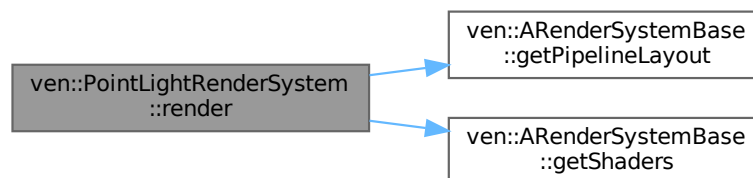
Implements [ven::ARenderSystemBase](#).

Definition at line 5 of file [pointLight.cpp](#).

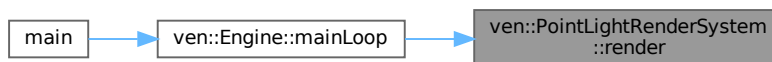
References [ven::FrameInfo::commandBuffer](#), [ven::ARenderSystemBase::getPipelineLayout\(\)](#), [ven::ARenderSystemBase::getShaders](#), [ven::FrameInfo::globalDescriptorSet](#), [ven::FrameInfo::lights](#), and [ven::LightPushConstantData::position](#).

Referenced by [ven::Engine::mainLoop\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



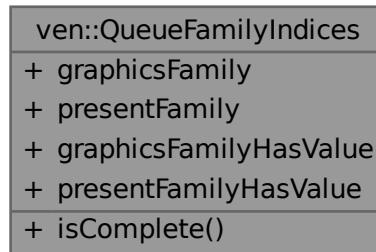
The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/PointLight.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Core/RenderSystems/pointLight.cpp](#)

7.33 ven::QueueFamilyIndices Struct Reference

```
#include <Device.hpp>
```

Collaboration diagram for ven::QueueFamilyIndices:



Public Member Functions

- bool [isComplete](#) () const

Public Attributes

- uint32_t [graphicsFamily](#) {}
- uint32_t [presentFamily](#) {}
- bool [graphicsFamilyHasValue](#) = false
- bool [presentFamilyHasValue](#) = false

7.33.1 Detailed Description

Definition at line 22 of file [Device.hpp](#).

7.33.2 Member Function Documentation

7.33.2.1 isComplete()

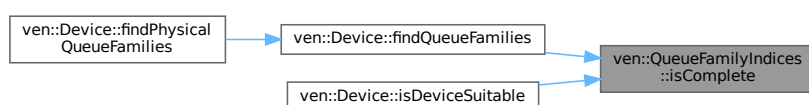
```
bool ven::QueueFamilyIndices::isComplete () const [inline], [nodiscard]
```

Definition at line 27 of file [Device.hpp](#).

References [graphicsFamilyHasValue](#), and [presentFamilyHasValue](#).

Referenced by [ven::Device::findQueueFamilies\(\)](#), and [ven::Device::isDeviceSuitable\(\)](#).

Here is the caller graph for this function:



7.33.3 Member Data Documentation

7.33.3.1 graphicsFamily

```
uint32_t ven::QueueFamilyIndices::graphicsFamily {}
```

Definition at line 23 of file [Device.hpp](#).

Referenced by [ven::Device::findQueueFamilies\(\)](#).

7.33.3.2 graphicsFamilyHasValue

```
bool ven::QueueFamilyIndices::graphicsFamilyHasValue = false
```

Definition at line 25 of file [Device.hpp](#).

Referenced by [ven::Device::findQueueFamilies\(\)](#), and [isComplete\(\)](#).

7.33.3.3 presentFamily

```
uint32_t ven::QueueFamilyIndices::presentFamily {}
```

Definition at line 24 of file [Device.hpp](#).

Referenced by [ven::Device::findQueueFamilies\(\)](#).

7.33.3.4 presentFamilyHasValue

```
bool ven::QueueFamilyIndices::presentFamilyHasValue = false
```

Definition at line 26 of file [Device.hpp](#).

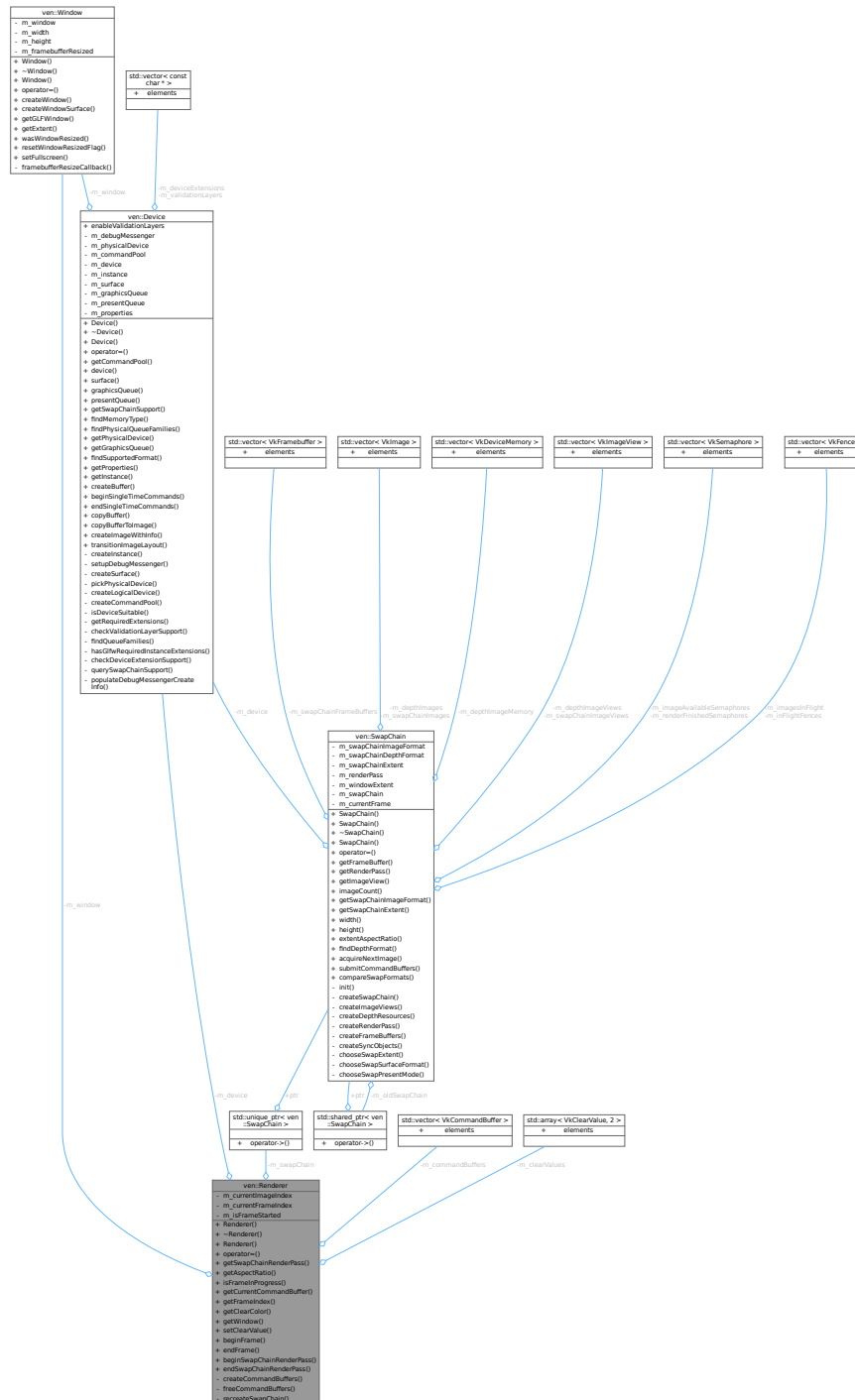
Referenced by [ven::Device::findQueueFamilies\(\)](#), and [isComplete\(\)](#).

The documentation for this struct was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/Device.hpp](#)

Class for renderer.

Collaboration diagram for `ven::Renderer`:



Public Member Functions

- [Renderer](#) ([Window](#) &window, [Device](#) &device)
- [~Renderer](#) ()
- [Renderer](#) (const [Renderer](#) &)=delete
- [Renderer](#) & [operator=](#) (const [Renderer](#) &)=delete
- [VkRenderPass](#) [getSwapChainRenderPass](#) () const
- [float](#) [getAspectRatio](#) () const
- [bool](#) [isFrameInProgress](#) () const
- [VkCommandBuffer](#) [getCurrentCommandBuffer](#) () const
- [unsigned long](#) [getFrameIndex](#) () const
- [std::array< float, 4 >](#) [getClearColor](#) () const
- [Window](#) & [getWindow](#) () const
- [void](#) [setClearValue](#) (const [VkClearColorValue](#) clearColorValue=[DEFAULT_CLEAR_COLOR](#), const [VkClearDepthStencilValue](#) clearDepthValue=[DEFAULT_CLEAR_DEPTH](#))
- [VkCommandBuffer](#) [beginFrame](#) ()
- [void](#) [endFrame](#) ()
- [void](#) [beginSwapChainRenderPass](#) ([VkCommandBuffer](#) commandBuffer) const
- [void](#) [endSwapChainRenderPass](#) ([VkCommandBuffer](#) commandBuffer) const

Private Member Functions

- [void](#) [createCommandBuffers](#) ()
- [void](#) [freeCommandBuffers](#) ()
- [void](#) [recreateSwapChain](#) ()

Private Attributes

- [Window](#) & [m_window](#)
- [Device](#) & [m_device](#)
- [std::unique_ptr< SwapChain >](#) [m_swapChain](#)
- [std::vector< VkCommandBuffer >](#) [m_commandBuffers](#)
- [std::array< VkClearColorValue, 2 >](#) [m_clearValues](#) {[DEFAULT_CLEAR_COLOR](#), 1.0F, 0.F}
- [uint32_t](#) [m_currentImageIndex](#) {0}
- [unsigned long](#) [m_currentFrameIndex](#) {0}
- [bool](#) [m_isFrameStarted](#) {false}

7.34.1 Detailed Description

Class for renderer.

Definition at line 24 of file [Renderer.hpp](#).

7.34.2 Constructor & Destructor Documentation

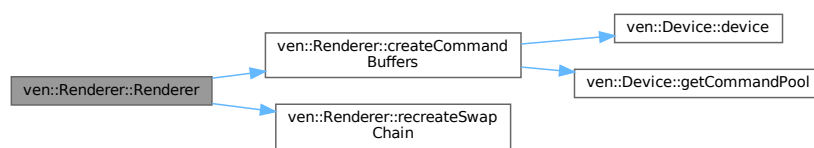
7.34.2.1 `Renderer()` [1/2]

```
ven::Renderer::Renderer (  
    Window & window,  
    Device & device) [inline]
```

Definition at line 28 of file [Renderer.hpp](#).

References [createCommandBuffers\(\)](#), and [recreateSwapChain\(\)](#).

Here is the call graph for this function:



7.34.2.2 `~Renderer()`

```
ven::Renderer::~~Renderer () [inline]
```

Definition at line 29 of file [Renderer.hpp](#).

References [freeCommandBuffers\(\)](#).

Here is the call graph for this function:



7.34.2.3 `Renderer()` [2/2]

```
ven::Renderer::Renderer (  
    const Renderer & ) [delete]
```

7.34.3 Member Function Documentation

7.34.3.1 beginFrame()

VkCommandBuffer ven::Renderer::beginFrame ()

Definition at line 43 of file [renderer.cpp](#).

7.34.3.2 beginSwapChainRenderPass()

```
void ven::Renderer::beginSwapChainRenderPass (  
    VkCommandBuffer commandBuffer) const
```

Definition at line 89 of file [renderer.cpp](#).

7.34.3.3 createCommandBuffers()

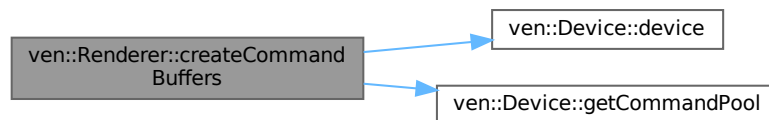
```
void ven::Renderer::createCommandBuffers () [private]
```

Definition at line 3 of file [renderer.cpp](#).

References [ven::Device::device\(\)](#), [ven::Device::getCommandPool\(\)](#), [m_commandBuffers](#), [m_device](#), and [ven::MAX_FRAMES_IN_FLIGHT](#).

Referenced by [Renderer\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.34.3.4 endFrame()

```
void ven::Renderer::endFrame ()
```

Definition at line 69 of file [renderer.cpp](#).

References [ven::MAX_FRAMES_IN_FLIGHT](#).

7.34.3.5 endSwapChainRenderPass()

```
void ven::Renderer::endSwapChainRenderPass (
    VkCommandBuffer commandBuffer) const
```

Definition at line 119 of file [renderer.cpp](#).

7.34.3.6 freeCommandBuffers()

```
void ven::Renderer::freeCommandBuffers () [private]
```

Definition at line 17 of file [renderer.cpp](#).

Referenced by [~Renderer\(\)](#).

Here is the caller graph for this function:



7.34.3.7 getAspectRatio()

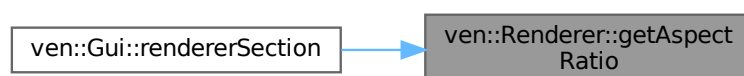
```
float ven::Renderer::getAspectRatio () const [inline], [nodiscard]
```

Definition at line 35 of file [Renderer.hpp](#).

References [m_swapChain](#).

Referenced by [ven::Gui::rendererSection\(\)](#).

Here is the caller graph for this function:



7.34.3.8 getClearColor()

```
std::array< float, 4 > ven::Renderer::getClearColor () const [inline], [nodiscard]
```

Definition at line 40 of file [Renderer.hpp](#).

References [m_clearValues](#).

Referenced by [ven::Gui::rendererSection\(\)](#).

Here is the caller graph for this function:



7.34.3.9 getCurrentCommandBuffer()

```
VkCommandBuffer ven::Renderer::getCurrentCommandBuffer () const [inline], [nodiscard]
```

Definition at line 37 of file [Renderer.hpp](#).

References [isFrameInProgress\(\)](#), [m_commandBuffers](#), and [m_currentFrameIndex](#).

Referenced by [ven::Gui::render\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



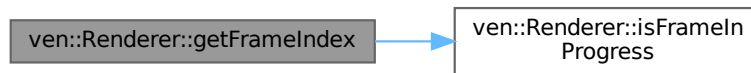
7.34.3.10 getFrameIndex()

```
unsigned long ven::Renderer::getFrameIndex () const [inline], [nodiscard]
```

Definition at line 39 of file [Renderer.hpp](#).

References [isFrameInProgress\(\)](#), and [m_currentFrameIndex](#).

Here is the call graph for this function:



7.34.3.11 getSwapChainRenderPass()

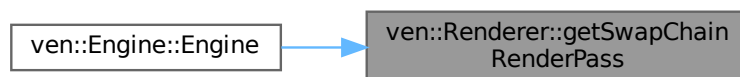
```
VkRenderPass ven::Renderer::getSwapChainRenderPass () const [inline], [nodiscard]
```

Definition at line 34 of file [Renderer.hpp](#).

References [m_swapChain](#).

Referenced by [ven::Engine::Engine\(\)](#).

Here is the caller graph for this function:



7.34.3.12 getWindow()

```
Window & ven::Renderer::getWindow () const [inline], [nodiscard]
```

Definition at line 47 of file [Renderer.hpp](#).

References [m_window](#).

Referenced by [ven::Gui::rendererSection\(\)](#).

Here is the caller graph for this function:



7.34.3.13 isFrameInProgress()

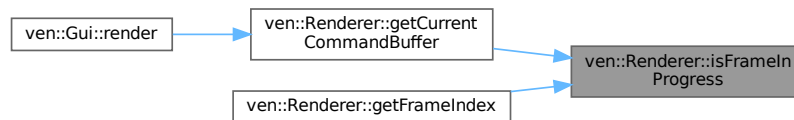
```
bool ven::Renderer::isFrameInProgress () const [inline], [nodiscard]
```

Definition at line 36 of file [Renderer.hpp](#).

References [m_isFrameStarted](#).

Referenced by [getCurrentCommandBuffer\(\)](#), and [getFrameIndex\(\)](#).

Here is the caller graph for this function:



7.34.3.14 operator=()

```
Renderer & ven::Renderer::operator= (
    const Renderer & ) [delete]
```

7.34.3.15 recreateSwapChain()

```
void ven::Renderer::recreateSwapChain () [private]
```

Definition at line 23 of file [renderer.cpp](#).

Referenced by [Renderer\(\)](#).

Here is the caller graph for this function:



7.34.3.16 setClearValue()

```
void ven::Renderer::setClearValue (
    const VkClearColorValue clearColorValue = DEFAULT_CLEAR_COLOR,
    const VkClearDepthStencilValue clearDepthValue = DEFAULT_CLEAR_DEPTH) [inline]
```

Definition at line 49 of file [Renderer.hpp](#).

References [m_clearValues](#).

Referenced by [ven::Gui::rendererSection\(\)](#).

Here is the caller graph for this function:



7.34.4 Member Data Documentation

7.34.4.1 m_clearValues

```
std::array<VkClearColorValue, 2> ven::Renderer::m_clearValues {DEFAULT_CLEAR_COLOR, 1.0F, 0.0F}
[private]
```

Definition at line 65 of file [Renderer.hpp](#).

Referenced by [getClearColor\(\)](#), and [setClearValue\(\)](#).

7.34.4.2 m_commandBuffers

```
std::vector<VkCommandBuffer> ven::Renderer::m_commandBuffers [private]
```

Definition at line 64 of file [Renderer.hpp](#).

Referenced by [createCommandBuffers\(\)](#), and [getCurrentCommandBuffer\(\)](#).

7.34.4.3 m_currentFrameIndex

```
unsigned long ven::Renderer::m_currentFrameIndex {0} [private]
```

Definition at line 68 of file [Renderer.hpp](#).

Referenced by [getCurrentCommandBuffer\(\)](#), and [getFrameIndex\(\)](#).

7.34.4.4 m_currentImageIndex

```
uint32_t ven::Renderer::m_currentImageIndex {0} [private]
```

Definition at line 67 of file [Renderer.hpp](#).

7.34.4.5 m_device

```
Device& ven::Renderer::m_device [private]
```

Definition at line 62 of file [Renderer.hpp](#).

Referenced by [createCommandBuffers\(\)](#).

7.34.4.6 m_isFrameStarted

```
bool ven::Renderer::m_isFrameStarted {false} [private]
```

Definition at line 69 of file [Renderer.hpp](#).

Referenced by [isFrameInProgress\(\)](#).

7.34.4.7 m_swapChain

```
std::unique_ptr<SwapChain> ven::Renderer::m_swapChain [private]
```

Definition at line 63 of file [Renderer.hpp](#).

Referenced by [getAspectRatio\(\)](#), and [getSwapChainRenderPass\(\)](#).

7.34.4.8 m_window

```
Window& ven::Renderer::m_window [private]
```

Definition at line 61 of file [Renderer.hpp](#).

Referenced by [getWindow\(\)](#).

The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Renderer.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/renderer.cpp](#)

Class for object manager.

```
#include <Manager.hpp>
```

Collaboration diagram for `ven::SceneManager`:



Public Member Functions

- [SceneManager](#) ([Device](#) &device)
- [SceneManager](#) (const [SceneManager](#) &)=delete
- [SceneManager](#) & operator= (const [SceneManager](#) &)=delete
- [SceneManager](#) ([SceneManager](#) &&)=delete
- [SceneManager](#) & operator= ([SceneManager](#) &&)=delete
- [Object](#) & [createObject](#) ()
- [Object](#) & [duplicateObject](#) (unsigned int objectId)
- [Light](#) & [createLight](#) (float radius=DEFAULT_LIGHT_RADIUS, glm::vec4 color=DEFAULT_LIGHT_COLOR)
- [Light](#) & [duplicateLight](#) (unsigned int lightId)
- void [destroyObject](#) (const unsigned int objectId)
- void [destroyLight](#) (const unsigned int lightId)
- void [destroyEntity](#) (std::vector< unsigned int > *objectIds, std::vector< unsigned int > *lightIds)
- void [updateBuffer](#) ([GlobalUbo](#) &ubo, unsigned long frameIndex, float frameTime)
- [VkDescriptorBufferInfo](#) [getBufferInfoForObject](#) (const int frameIndex, const unsigned int objectId) const
- [Object::Map](#) & [getObjects](#) ()
- [Light::Map](#) & [getLights](#) ()
- std::vector< std::unique_ptr< [Buffer](#) > > & [getUboBuffers](#) ()
- bool [getDestroyState](#) () const
- void [setDestroyState](#) (const bool state)

Private Attributes

- unsigned int [m_currentObjId](#) {0}
- unsigned int [m_currentLightId](#) {0}
- std::shared_ptr< [Texture](#) > [m_textureDefault](#)
- [Object::Map](#) [m_objects](#)
- [Light::Map](#) [m_lights](#)
- std::vector< std::unique_ptr< [Buffer](#) > > [m_uboBuffers](#) {MAX_FRAMES_IN_FLIGHT}
- bool [m_destroyState](#) {false}

7.35.1 Detailed Description

Class for object manager.

Definition at line 19 of file [Manager.hpp](#).

7.35.2 Constructor & Destructor Documentation

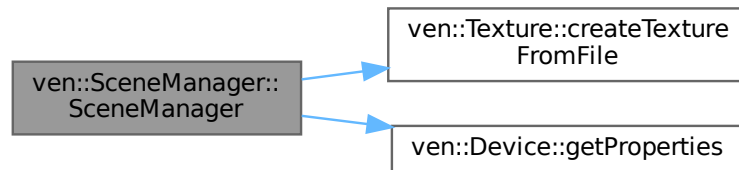
7.35.2.1 SceneManager() [1/3]

```
ven::SceneManager::SceneManager (
    Device & device) [explicit]
```

Definition at line 6 of file [manager.cpp](#).

References [ven::Texture::createTextureFromFile\(\)](#), [ven::Device::getProperties\(\)](#), [m_textureDefault](#), [m_uboBuffers](#), and [ven::MAX_OBJECTS](#).

Here is the call graph for this function:



7.35.2.2 SceneManager() [2/3]

```
ven::SceneManager::SceneManager (
    const SceneManager & ) [delete]
```

7.35.2.3 SceneManager() [3/3]

```
ven::SceneManager::SceneManager (
    SceneManager && ) [delete]
```

7.35.3 Member Function Documentation

7.35.3.1 createLight()

```
ven::Light & ven::SceneManager::createLight (
    float radius = DEFAULT_LIGHT_RADIUS,
    glm::vec4 color = DEFAULT_LIGHT_COLOR)
```

Definition at line 47 of file [manager.cpp](#).

References [ven::Light::color](#), [ven::Light::getId\(\)](#), [ven::MAX_LIGHTS](#), [ven::Transform3D::scale](#), and [ven::Light::transform](#).

Here is the call graph for this function:



7.35.3.2 createObject()

`ven::Object & ven::SceneManager::createObject ()`

Definition at line 26 of file [manager.cpp](#).

References [ven::MAX_OBJECTS](#).

7.35.3.3 destroyEntity()

```
void ven::SceneManager::destroyEntity (
    std::vector< unsigned int > * objectsIds,
    std::vector< unsigned int > * lightsIds)
```

Definition at line 91 of file [manager.cpp](#).

7.35.3.4 destroyLight()

```
void ven::SceneManager::destroyLight (
    const unsigned int lightId) [inline]
```

Definition at line 36 of file [Manager.hpp](#).

References [m_lights](#).

7.35.3.5 destroyObject()

```
void ven::SceneManager::destroyObject (
    const unsigned int objectId) [inline]
```

Definition at line 35 of file [Manager.hpp](#).

References [m_objects](#).

7.35.3.6 duplicateLight()

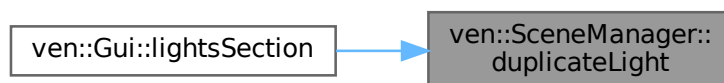
```
ven::Light & ven::SceneManager::duplicateLight (
    unsigned int lightId)
```

Definition at line 58 of file [manager.cpp](#).

References [ven::Light::color](#), [ven::Transform3D::scale](#), and [ven::Light::transform](#).

Referenced by [ven::Gui::lightsSection\(\)](#).

Here is the caller graph for this function:



7.35.3.7 duplicateObject()

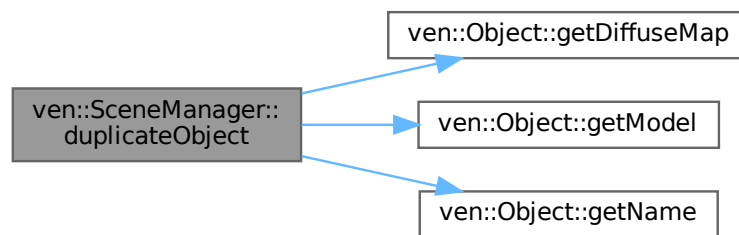
```
ven::Object & ven::SceneManager::duplicateObject (
    unsigned int objectId)
```

Definition at line 36 of file [manager.cpp](#).

References [ven::Object::getDiffuseMap\(\)](#), [ven::Object::getModel\(\)](#), [ven::Object::getName\(\)](#), and [ven::Object::transform](#).

Referenced by [ven::Gui::objectsSection\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.35.3.8 getBufferInfoForObject()

```
VkDescriptorBufferInfo ven::SceneManager::getBufferInfoForObject (
    const int frameIndex,
    const unsigned int objectId) const [inline]
```

Definition at line 41 of file [Manager.hpp](#).

References [m_uboBuffers](#).

7.35.3.9 getDestroyState()

```
bool ven::SceneManager::getDestroyState () const [inline]
```

Definition at line 45 of file [Manager.hpp](#).

References [m_destroyState](#).

7.35.3.10 getLights()

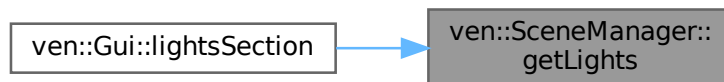
```
Light::Map & ven::SceneManager::getLights () [inline]
```

Definition at line 43 of file [Manager.hpp](#).

References [m_lights](#).

Referenced by [ven::Gui::lightsSection\(\)](#).

Here is the caller graph for this function:



7.35.3.11 getObjects()

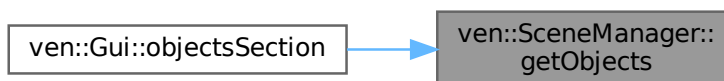
```
Object::Map & ven::SceneManager::getObjects () [inline]
```

Definition at line 42 of file [Manager.hpp](#).

References [m_objects](#).

Referenced by [ven::Gui::objectsSection\(\)](#).

Here is the caller graph for this function:



7.35.3.12 getUboBuffers()

```
std::vector< std::unique_ptr< Buffer > > & ven::SceneManager::getUboBuffers () [inline]
```

Definition at line 44 of file [Manager.hpp](#).

References [m_uboBuffers](#).

7.35.3.13 operator=() [1/2]

```
SceneManager & ven::SceneManager::operator= (
    const SceneManager & ) [delete]
```

7.35.3.14 operator=() [2/2]

```
SceneManager & ven::SceneManager::operator= (
    SceneManager && ) [delete]
```

7.35.3.15 setDestroyState()

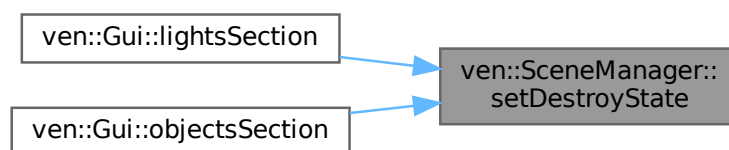
```
void ven::SceneManager::setDestroyState (
    const bool state) [inline]
```

Definition at line 47 of file [Manager.hpp](#).

References [m_destroyState](#).

Referenced by [ven::Gui::lightsSection\(\)](#), and [ven::Gui::objectsSection\(\)](#).

Here is the caller graph for this function:

**7.35.3.16 updateBuffer()**

```
void ven::SceneManager::updateBuffer (
    GlobalUbo & ubo,
    unsigned long frameIndex,
    float frameTime)
```

Definition at line 66 of file [manager.cpp](#).

References [ven::ObjectBufferData::modelMatrix](#), [ven::GlobalUbo::numLights](#), and [ven::GlobalUbo::pointLights](#).

7.35.4 Member Data Documentation

7.35.4.1 m_currentLightId

```
unsigned int ven::SceneManager::m_currentLightId {0} [private]
```

Definition at line 52 of file [Manager.hpp](#).

7.35.4.2 m_currentObjId

```
unsigned int ven::SceneManager::m_currentObjId {0} [private]
```

Definition at line 51 of file [Manager.hpp](#).

7.35.4.3 m_destroyState

```
bool ven::SceneManager::m_destroyState {false} [private]
```

Definition at line 57 of file [Manager.hpp](#).

Referenced by [getDestroyState\(\)](#), and [setDestroyState\(\)](#).

7.35.4.4 m_lights

```
Light::Map ven::SceneManager::m_lights [private]
```

Definition at line 55 of file [Manager.hpp](#).

Referenced by [destroyLight\(\)](#), and [getLights\(\)](#).

7.35.4.5 m_objects

```
Object::Map ven::SceneManager::m_objects [private]
```

Definition at line 54 of file [Manager.hpp](#).

Referenced by [destroyObject\(\)](#), and [getObjects\(\)](#).

7.35.4.6 m_textureDefault

```
std::shared_ptr<Texture> ven::SceneManager::m_textureDefault [private]
```

Definition at line 53 of file [Manager.hpp](#).

Referenced by [SceneManager\(\)](#).

7.35.4.7 m_uboBuffers

```
std::vector<std::unique_ptr<Buffer>> > ven::SceneManager::m_uboBuffers {MAX_FRAMES_IN_FLIGHT}  
[private]
```

Definition at line 56 of file [Manager.hpp](#).

Referenced by [getBufferInfoForObject\(\)](#), [getUboBuffers\(\)](#), and [SceneManager\(\)](#).

The documentation for this class was generated from the following files:

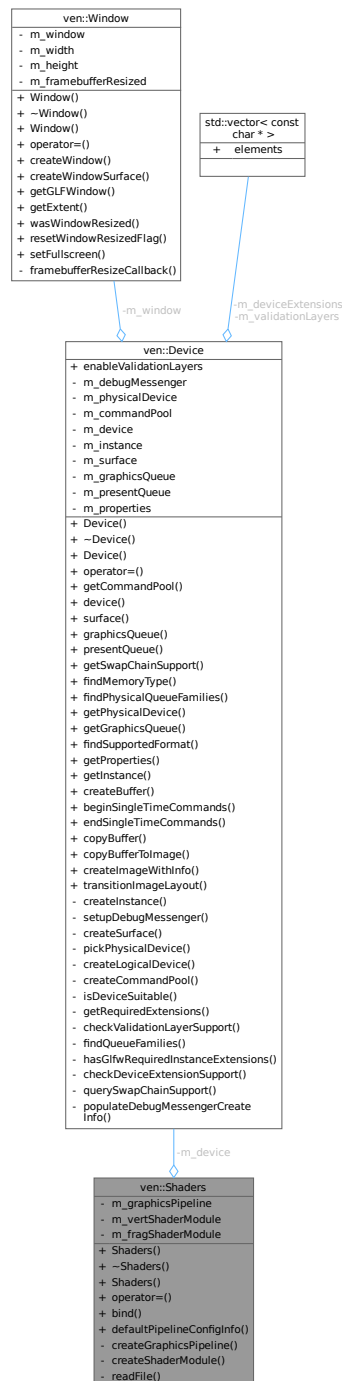
- [/home/runner/work/VEngine/VEngine/include/VEngine/Scene/Manager.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Scene/manager.cpp](#)

7.36 ven::Shaders Class Reference

Class for shaders.

```
#include <Shaders.hpp>
```

Collaboration diagram for ven::Shaders:



Public Member Functions

- **Shaders** (**Device** &device, const std::string &vertFilepath, const std::string &fragFilepath, const PipelineConfigInfo &configInfo)
- **~Shaders** ()
- **Shaders** (const **Shaders** &)=delete
- **Shaders** & **operator=** (const **Shaders** &)=delete
- void **bind** (const VkCommandBuffer commandBuffer) const

Static Public Member Functions

- static void [defaultPipelineConfigInfo](#) ([PipelineConfigInfo](#) &configInfo)

Private Member Functions

- void [createGraphicsPipeline](#) (const std::string &vertFilepath, const std::string &fragFilepath, const [PipelineConfigInfo](#) &configInfo)
- void [createShaderModule](#) (const std::vector< char > &code, VkShaderModule *shaderModule) const

Static Private Member Functions

- static std::vector< char > [readFile](#) (const std::string &filename)

Private Attributes

- [Device](#) & [m_device](#)
- VkPipeline [m_graphicsPipeline](#) {nullptr}
- VkShaderModule [m_vertShaderModule](#) {nullptr}
- VkShaderModule [m_fragShaderModule](#) {nullptr}

7.36.1 Detailed Description

Class for shaders.

Definition at line 40 of file [Shaders.hpp](#).

7.36.2 Constructor & Destructor Documentation

7.36.2.1 Shaders() [1/2]

```
ven::Shaders::Shaders (
    Device & device,
    const std::string & vertFilepath,
    const std::string & fragFilepath,
    const PipelineConfigInfo & configInfo) [inline]
```

Definition at line 44 of file [Shaders.hpp](#).

References [createGraphicsPipeline\(\)](#).

Here is the call graph for this function:



7.36.2.2 ~Shaders()

```
ven::Shaders::~~Shaders ()
```

Definition at line 7 of file [shaders.cpp](#).

References [ven::Device::device\(\)](#), [m_device](#), [m_fragShaderModule](#), [m_graphicsPipeline](#), and [m_vertShaderModule](#).

Here is the call graph for this function:



7.36.2.3 Shaders() [2/2]

```
ven::Shaders::Shaders (
    const Shaders & ) [delete]
```

7.36.3 Member Function Documentation

7.36.3.1 bind()

```
void ven::Shaders::bind (
    const VkCommandBuffer commandBuffer) const [inline]
```

Definition at line 51 of file [Shaders.hpp](#).

References [m_graphicsPipeline](#).

7.36.3.2 createGraphicsPipeline()

```
void ven::Shaders::createGraphicsPipeline (
    const std::string & vertFilepath,
    const std::string & fragFilepath,
    const PipelineConfigInfo & configInfo) [private]
```

Definition at line 27 of file [shaders.cpp](#).

References [ven::PipelineConfigInfo::attributeDescriptions](#), [ven::PipelineConfigInfo::bindingDescriptions](#), [ven::PipelineConfigInfo::colorBlendEquation](#), [ven::PipelineConfigInfo::depthStencilInfo](#), [ven::PipelineConfigInfo::dynamicStateInfo](#), [ven::PipelineConfigInfo::inputAssemblyInfo](#), [ven::PipelineConfigInfo::multisampleInfo](#), [ven::PipelineConfigInfo::pipelineLayout](#), [ven::PipelineConfigInfo::rasterizationInfo](#), [ven::PipelineConfigInfo::renderPass](#), and [ven::PipelineConfigInfo::subpass](#).

Referenced by [Shaders\(\)](#).

Here is the caller graph for this function:



7.36.3.3 createShaderModule()

```
void ven::Shaders::createShaderModule (
    const std::vector< char > & code,
    VkShaderModule * shaderModule) const [private]
```

Definition at line 96 of file [shaders.cpp](#).

7.36.3.4 defaultPipelineConfigInfo()

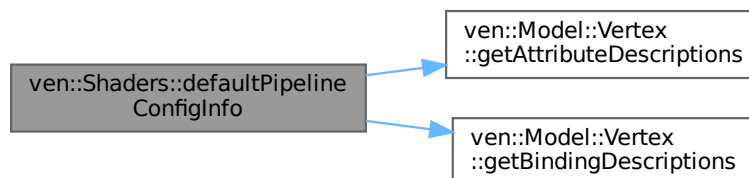
```
void ven::Shaders::defaultPipelineConfigInfo (
    PipelineConfigInfo & configInfo) [static]
```

Definition at line 108 of file [shaders.cpp](#).

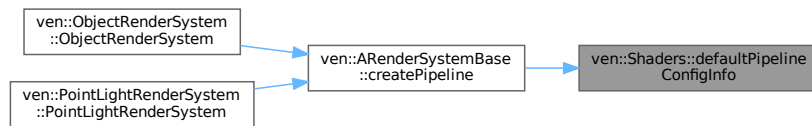
References [ven::PipelineConfigInfo::attributeDescriptions](#), [ven::PipelineConfigInfo::bindingDescriptions](#), [ven::PipelineConfigInfo::colorBlendInfo](#), [ven::PipelineConfigInfo::colorBlendInfo](#), [ven::PipelineConfigInfo::depthStencilInfo](#), [ven::PipelineConfigInfo::dynamicStateEnables](#), [ven::PipelineConfigInfo::dynamicStateInfo](#), [ven::Model::Vertex::getAttributeDescriptions\(\)](#), [ven::Model::Vertex::getBindingDescriptions\(\)](#), [ven::PipelineConfigInfo::inputAssemblyInfo](#), [ven::PipelineConfigInfo::multisampleInfo](#), and [ven::PipelineConfigInfo::rasterizationInfo](#).

Referenced by [ven::ARenderSystemBase::createPipeline\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



7.36.3.5 operator=()

```
Shaders & ven::Shaders::operator= (
    const Shaders & ) [delete]
```

7.36.3.6 readFile()

```
std::vector< char > ven::Shaders::readFile (
    const std::string & filename) [static], [private]
```

Definition at line 14 of file [shaders.cpp](#).

7.36.4 Member Data Documentation

7.36.4.1 m_device

```
Device& ven::Shaders::m_device [private]
```

Definition at line 59 of file [Shaders.hpp](#).

Referenced by [~Shaders\(\)](#).

7.36.4.2 m_fragShaderModule

```
VkShaderModule ven::Shaders::m_fragShaderModule {nullptr} [private]
```

Definition at line 62 of file [Shaders.hpp](#).

Referenced by [~Shaders\(\)](#).

7.36.4.3 m_graphicsPipeline

```
VkPipeline ven::Shaders::m_graphicsPipeline {nullptr} [private]
```

Definition at line 60 of file [Shaders.hpp](#).

Referenced by [bind\(\)](#), and [~Shaders\(\)](#).

7.36.4.4 m_vertShaderModule

```
VkShaderModule ven::Shaders::m_vertShaderModule {nullptr} [private]
```

Definition at line 61 of file [Shaders.hpp](#).

Referenced by [~Shaders\(\)](#).

The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Shaders.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/shaders.cpp](#)

7.37 ven::SwapChain Class Reference

Class for swap chain.

```
#include <SwapChain.hpp>
```


- `size_t imageCount () const`
- `VkFormat getSwapChainImageFormat () const`
- `VkExtent2D getSwapChainExtent () const`
- `uint32_t width () const`
- `uint32_t height () const`
- `float extentAspectRatio () const`
- `VkFormat findDepthFormat () const`
- `VkResult acquireNextImage (uint32_t *imageIndex) const`
- `VkResult submitCommandBuffers (const VkCommandBuffer *buffers, const uint32_t *imageIndex)`
- `bool compareSwapFormats (const SwapChain &swapChain) const`

Private Member Functions

- `void init ()`
- `void createSwapChain ()`
- `void createImageViews ()`
- `void createDepthResources ()`
- `void createRenderPass ()`
- `void createFrameBuffers ()`
- `void createSyncObjects ()`
- `VkExtent2D chooseSwapExtent (const VkSurfaceCapabilitiesKHR &capabilities) const`

Static Private Member Functions

- `static VkSurfaceFormatKHR chooseSwapSurfaceFormat (const std::vector< VkSurfaceFormatKHR > &availableFormats)`
- `static VkPresentModeKHR chooseSwapPresentMode (const std::vector< VkPresentModeKHR > &availablePresentModes)`

Private Attributes

- `VkFormat m_swapChainImageFormat {}`
- `VkFormat m_swapChainDepthFormat {}`
- `VkExtent2D m_swapChainExtent {}`
- `std::vector< VkFramebuffer > m_swapChainFrameBuffers`
- `VkRenderPass m_renderPass {}`
- `std::vector< VkImage > m_depthImages`
- `std::vector< VkDeviceMemory > m_depthImageMemory`
- `std::vector< VkImageView > m_depthImageViews`
- `std::vector< VkImage > m_swapChainImages`
- `std::vector< VkImageView > m_swapChainImageViews`
- `Device & m_device`
- `VkExtent2D m_windowExtent`
- `VkSwapchainKHR m_swapChain {}`
- `std::shared_ptr< SwapChain > m_oldSwapChain`
- `std::vector< VkSemaphore > m_imageAvailableSemaphores`
- `std::vector< VkSemaphore > m_renderFinishedSemaphores`
- `std::vector< VkFence > m_inFlightFences`
- `std::vector< VkFence > m_imagesInFlight`
- `size_t m_currentFrame {0}`

7.37.1 Detailed Description

Class for swap chain.

Definition at line 22 of file [SwapChain.hpp](#).

7.37.2 Constructor & Destructor Documentation

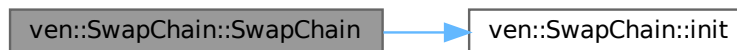
7.37.2.1 SwapChain() [1/3]

```
ven::SwapChain::SwapChain (  
    Device & deviceRef,  
    const VkExtent2D windowExtentRef) [inline]
```

Definition at line 26 of file [SwapChain.hpp](#).

References [init\(\)](#).

Here is the call graph for this function:



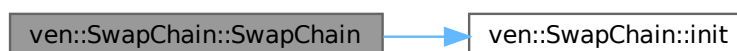
7.37.2.2 SwapChain() [2/3]

```
ven::SwapChain::SwapChain (  
    Device & deviceRef,  
    const VkExtent2D windowExtentRef,  
    std::shared_ptr< SwapChain > previous) [inline]
```

Definition at line 27 of file [SwapChain.hpp](#).

References [init\(\)](#), and [m_oldSwapChain](#).

Here is the call graph for this function:



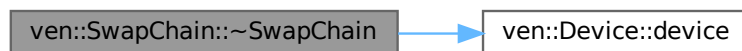
7.37.2.3 ~SwapChain()

```
ven::SwapChain::~~SwapChain ()
```

Definition at line 7 of file [swapChain.cpp](#).

References [ven::Device::device\(\)](#), [m_depthImageMemory](#), [m_depthImages](#), [m_depthImageViews](#), [m_device](#), [m_imageAvailableSemaphores](#), [m_inFlightFences](#), [m_renderFinishedSemaphores](#), [m_renderPass](#), [m_swapChain](#), [m_swapChainFrameBuffers](#), [m_swapChainImageViews](#), and [ven::MAX_FRAMES_IN_FLIGHT](#).

Here is the call graph for this function:



7.37.2.4 SwapChain() [3/3]

```
ven::SwapChain::SwapChain (
    const SwapChain & ) [delete]
```

7.37.3 Member Function Documentation

7.37.3.1 acquireNextImage()

```
VkResult ven::SwapChain::acquireNextImage (
    uint32_t * imageIndex) const
```

Definition at line 49 of file [swapChain.cpp](#).

7.37.3.2 chooseSwapExtent()

```
VkExtent2D ven::SwapChain::chooseSwapExtent (
    const VkSurfaceCapabilitiesKHR & capabilities) const [nodiscard], [private]
```

Definition at line 362 of file [swapChain.cpp](#).

7.37.3.3 chooseSwapPresentMode()

```
VkPresentModeKHR ven::SwapChain::chooseSwapPresentMode (
    const std::vector< VkPresentModeKHR > & availablePresentModes) [static], [private]
```

Definition at line 342 of file [swapChain.cpp](#).

7.37.3.4 chooseSwapSurfaceFormat()

```
VkSurfaceFormatKHR ven::SwapChain::chooseSwapSurfaceFormat (  
    const std::vector< VkSurfaceFormatKHR > & availableFormats) [static], [private]
```

Definition at line 331 of file [swapChain.cpp](#).

7.37.3.5 compareSwapFormats()

```
bool ven::SwapChain::compareSwapFormats (  
    const SwapChain & swapChain) const [inline], [nodiscard]
```

Definition at line 48 of file [SwapChain.hpp](#).

References [m_swapChainDepthFormat](#), and [m_swapChainImageFormat](#).

7.37.3.6 createDepthResources()

```
void ven::SwapChain::createDepthResources () [private]
```

Definition at line 262 of file [swapChain.cpp](#).

7.37.3.7 createFrameBuffers()

```
void ven::SwapChain::createFrameBuffers () [private]
```

Definition at line 240 of file [swapChain.cpp](#).

7.37.3.8 createImageViews()

```
void ven::SwapChain::createImageViews () [private]
```

Definition at line 160 of file [swapChain.cpp](#).

7.37.3.9 createRenderPass()

```
void ven::SwapChain::createRenderPass () [private]
```

Definition at line 181 of file [swapChain.cpp](#).

7.37.3.10 createSwapChain()

```
void ven::SwapChain::createSwapChain () [private]
```

Definition at line 103 of file [swapChain.cpp](#).

7.37.3.11 createSyncObjects()

```
void ven::SwapChain::createSyncObjects () [private]
```

Definition at line 308 of file [swapChain.cpp](#).

References [ven::MAX_FRAMES_IN_FLIGHT](#).

7.37.3.12 extentAspectRatio()

```
float ven::SwapChain::extentAspectRatio () const [inline], [nodiscard]
```

Definition at line 42 of file [SwapChain.hpp](#).

References [m_swapChainExtent](#).

7.37.3.13 findDepthFormat()

```
VkFormat ven::SwapChain::findDepthFormat () const [nodiscard]
```

Definition at line 374 of file [swapChain.cpp](#).

7.37.3.14 getFrameBuffer()

```
VkFramebuffer ven::SwapChain::getFrameBuffer (  
    const unsigned long index) const [inline], [nodiscard]
```

Definition at line 33 of file [SwapChain.hpp](#).

References [m_swapChainFrameBuffers](#).

7.37.3.15 getImageView()

```
VkImageView ven::SwapChain::getImageView (  
    const int index) const [inline], [nodiscard]
```

Definition at line 35 of file [SwapChain.hpp](#).

References [m_swapChainImageViews](#).

7.37.3.16 getRenderPass()

```
VkRenderPass ven::SwapChain::getRenderPass () const [inline], [nodiscard]
```

Definition at line 34 of file [SwapChain.hpp](#).

References [m_renderPass](#).

7.37.3.17 getSwapChainExtent()

```
VkExtent2D ven::SwapChain::getSwapChainExtent () const [inline], [nodiscard]
```

Definition at line 38 of file [SwapChain.hpp](#).

References [m_swapChainExtent](#).

7.37.3.18 getSwapChainImageFormat()

```
VkFormat ven::SwapChain::getSwapChainImageFormat () const [inline], [nodiscard]
```

Definition at line 37 of file [SwapChain.hpp](#).

References [m_swapChainImageFormat](#).

7.37.3.19 height()

```
uint32_t ven::SwapChain::height () const [inline], [nodiscard]
```

Definition at line 40 of file [SwapChain.hpp](#).

References [m_swapChainExtent](#).

7.37.3.20 imageCount()

```
size_t ven::SwapChain::imageCount () const [inline], [nodiscard]
```

Definition at line 36 of file [SwapChain.hpp](#).

References [m_swapChainImages](#).

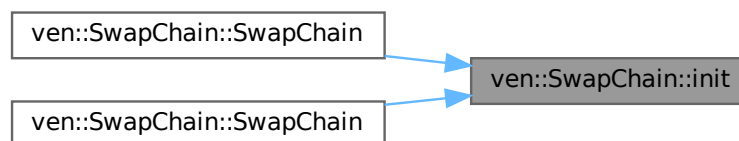
7.37.3.21 init()

```
void ven::SwapChain::init () [private]
```

Definition at line 39 of file [swapChain.cpp](#).

Referenced by [SwapChain\(\)](#), and [SwapChain\(\)](#).

Here is the caller graph for this function:



7.37.3.22 operator=()

```
SwapChain & ven::SwapChain::operator= (
    const SwapChain & ) [delete]
```

7.37.3.23 submitCommandBuffers()

```
VkResult ven::SwapChain::submitCommandBuffers (
    const VkCommandBuffer * buffers,
    const uint32_t * imageIndex)
```

Definition at line 56 of file [swapChain.cpp](#).

References [ven::MAX_FRAMES_IN_FLIGHT](#).

7.37.3.24 width()

```
uint32_t ven::SwapChain::width () const [inline], [nodiscard]
```

Definition at line 39 of file [SwapChain.hpp](#).

References [m_swapChainExtent](#).

7.37.4 Member Data Documentation

7.37.4.1 m_currentFrame

```
size_t ven::SwapChain::m_currentFrame {0} [private]
```

Definition at line 87 of file [SwapChain.hpp](#).

7.37.4.2 m_depthImageMemory

```
std::vector<VkDeviceMemory> ven::SwapChain::m_depthImageMemory [private]
```

Definition at line 72 of file [SwapChain.hpp](#).

Referenced by [~SwapChain\(\)](#).

7.37.4.3 m_depthImages

```
std::vector<VkImage> ven::SwapChain::m_depthImages [private]
```

Definition at line 71 of file [SwapChain.hpp](#).

Referenced by [~SwapChain\(\)](#).

7.37.4.4 m_depthImageViews

```
std::vector<VkImageView> ven::SwapChain::m_depthImageViews [private]
```

Definition at line 73 of file [SwapChain.hpp](#).

Referenced by [~SwapChain\(\)](#).

7.37.4.5 m_device

```
Device& ven::SwapChain::m_device [private]
```

Definition at line 77 of file [SwapChain.hpp](#).

Referenced by [~SwapChain\(\)](#).

7.37.4.6 m_imageAvailableSemaphores

```
std::vector<VkSemaphore> ven::SwapChain::m_imageAvailableSemaphores [private]
```

Definition at line 83 of file [SwapChain.hpp](#).

Referenced by [~SwapChain\(\)](#).

7.37.4.7 m_imagesInFlight

```
std::vector<VkFence> ven::SwapChain::m_imagesInFlight [private]
```

Definition at line 86 of file [SwapChain.hpp](#).

7.37.4.8 m_inFlightFences

```
std::vector<VkFence> ven::SwapChain::m_inFlightFences [private]
```

Definition at line 85 of file [SwapChain.hpp](#).

Referenced by [~SwapChain\(\)](#).

7.37.4.9 m_oldSwapChain

```
std::shared_ptr<SwapChain> ven::SwapChain::m_oldSwapChain [private]
```

Definition at line 81 of file [SwapChain.hpp](#).

Referenced by [SwapChain\(\)](#).

7.37.4.10 m_renderFinishedSemaphores

```
std::vector<VkSemaphore> ven::SwapChain::m_renderFinishedSemaphores [private]
```

Definition at line 84 of file [SwapChain.hpp](#).

Referenced by [~SwapChain\(\)](#).

7.37.4.11 m_renderPass

```
VkRenderPass ven::SwapChain::m_renderPass {} [private]
```

Definition at line 69 of file [SwapChain.hpp](#).

Referenced by [getRenderPass\(\)](#), and [~SwapChain\(\)](#).

7.37.4.12 m_swapChain

```
VkSwapchainKHR ven::SwapChain::m_swapChain {} [private]
```

Definition at line 80 of file [SwapChain.hpp](#).

Referenced by [~SwapChain\(\)](#).

7.37.4.13 m_swapChainDepthFormat

```
VkFormat ven::SwapChain::m_swapChainDepthFormat {} [private]
```

Definition at line 65 of file [SwapChain.hpp](#).

Referenced by [compareSwapFormats\(\)](#).

7.37.4.14 m_swapChainExtent

```
VkExtent2D ven::SwapChain::m_swapChainExtent {} [private]
```

Definition at line 66 of file [SwapChain.hpp](#).

Referenced by [extentAspectRatio\(\)](#), [getSwapChainExtent\(\)](#), [height\(\)](#), and [width\(\)](#).

7.37.4.15 m_swapChainFrameBuffers

```
std::vector<VkFramebuffer> ven::SwapChain::m_swapChainFrameBuffers [private]
```

Definition at line 68 of file [SwapChain.hpp](#).

Referenced by [getFramebuffer\(\)](#), and [~SwapChain\(\)](#).

7.37.4.16 m_swapChainImageFormat

VkFormat ven::SwapChain::m_swapChainImageFormat {} [private]

Definition at line 64 of file [SwapChain.hpp](#).

Referenced by [compareSwapFormats\(\)](#), and [getSwapChainImageFormat\(\)](#).

7.37.4.17 m_swapChainImages

std::vector<VkImage> ven::SwapChain::m_swapChainImages [private]

Definition at line 74 of file [SwapChain.hpp](#).

Referenced by [imageCount\(\)](#).

7.37.4.18 m_swapChainImageViews

std::vector<VkImageView> ven::SwapChain::m_swapChainImageViews [private]

Definition at line 75 of file [SwapChain.hpp](#).

Referenced by [getImageView\(\)](#), and [~SwapChain\(\)](#).

7.37.4.19 m_windowExtent

VkExtent2D ven::SwapChain::m_windowExtent [private]

Definition at line 78 of file [SwapChain.hpp](#).

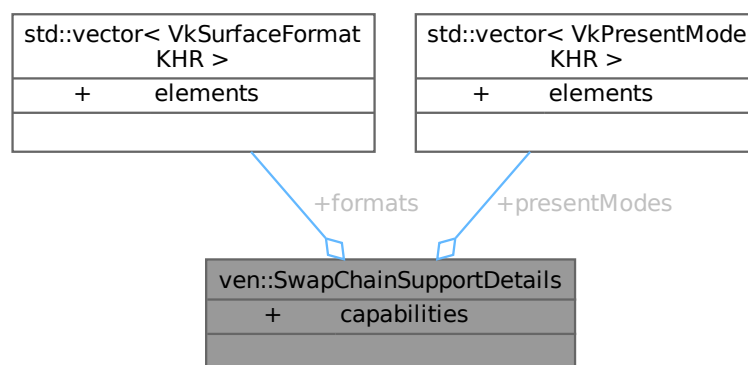
The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/SwapChain.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/swapChain.cpp](#)

7.38 ven::SwapChainSupportDetails Struct Reference

```
#include <Device.hpp>
```

Collaboration diagram for ven::SwapChainSupportDetails:



Public Attributes

- VkSurfaceCapabilitiesKHR [capabilities](#)
- std::vector< VkSurfaceFormatKHR > [formats](#)
- std::vector< VkPresentModeKHR > [presentModes](#)

7.38.1 Detailed Description

Definition at line 16 of file [Device.hpp](#).

7.38.2 Member Data Documentation

7.38.2.1 capabilities

```
VkSurfaceCapabilitiesKHR ven::SwapChainSupportDetails::capabilities
```

Definition at line 17 of file [Device.hpp](#).

Referenced by [ven::Device::querySwapChainSupport\(\)](#).

7.38.2.2 formats

```
std::vector<VkSurfaceFormatKHR> ven::SwapChainSupportDetails::formats
```

Definition at line 18 of file [Device.hpp](#).

Referenced by [ven::Device::querySwapChainSupport\(\)](#).

7.38.2.3 presentModes

```
std::vector<VkPresentModeKHR> ven::SwapChainSupportDetails::presentModes
```

Definition at line 19 of file [Device.hpp](#).

Referenced by [ven::Device::querySwapChainSupport\(\)](#).

The documentation for this struct was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/Device.hpp](#)

7.39 ven::Texture Class Reference

Class for texture.

```
#include <Texture.hpp>
```

Collaboration diagram for ven::Texture:



Public Member Functions

- [Texture](#) ([Device](#) &device, const std::string &textureFilepath)
- [Texture](#) ([Device](#) &device, VkFormat format, VkExtent3D extent, VkImageUsageFlags usage, VkSampleCountFlagBits sampleCount)
- [~Texture](#) ()
- [Texture](#) (const [Texture](#) &)=delete
- [Texture](#) & [operator=](#) (const [Texture](#) &)=delete
- void [updateDescriptor](#) ()
- void [transitionLayout](#) (VkCommandBuffer commandBuffer, VkImageLayout oldLayout, VkImageLayout newLayout) const
- VkImageView [imageView](#) () const
- VkSampler [sampler](#) () const
- VkImage [getImage](#) () const
- VkImageView [getImageView](#) () const
- VkDescriptorImageInfo [getImageInfo](#) () const
- VkImageLayout [getImageLayout](#) () const
- VkExtent3D [getExtent](#) () const
- VkFormat [getFormat](#) () const

Static Public Member Functions

- static std::unique_ptr< [Texture](#) > [createTextureFromFile](#) ([Device](#) &device, const std::string &filepath)

Private Member Functions

- void [createTextureImage](#) (const std::string &filepath)
- void [createTextureImageView](#) (VkImageViewType viewType)
- void [createTextureSampler](#) ()

Private Attributes

- VkDescriptorImageInfo [m_descriptor](#) {}
- [Device](#) & [m_device](#)
- VkImage [m_textureImage](#) = nullptr
- VkDeviceMemory [m_textureImageMemory](#) = nullptr
- VkImageView [m_textureImageView](#) = nullptr
- VkSampler [m_textureSampler](#) = nullptr
- VkFormat [m_format](#)
- VkImageLayout [m_textureLayout](#) {}
- uint32_t [m_mipLevels](#) {1}
- uint32_t [m_layerCount](#) {1}
- VkExtent3D [m_extent](#) {}

7.39.1 Detailed Description

Class for texture.

Definition at line 20 of file [Texture.hpp](#).

7.39.2 Constructor & Destructor Documentation

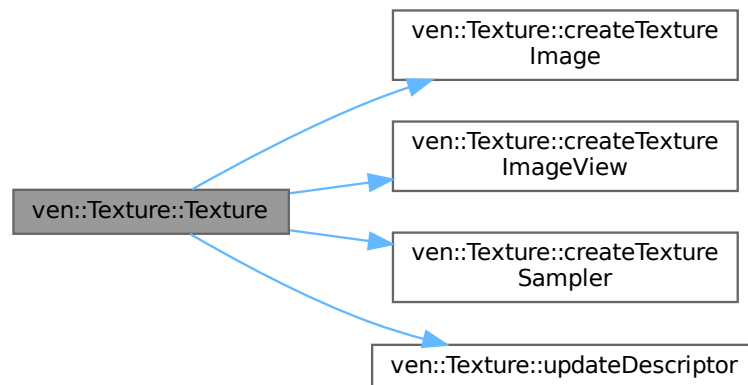
7.39.2.1 Texture() [1/3]

```
ven::Texture::Texture (
    Device & device,
    const std::string & textureFilepath)
```

Definition at line 6 of file [texture.cpp](#).

References [createTextureImage\(\)](#), [createTextureImageView\(\)](#), [createTextureSampler\(\)](#), and [updateDescriptor\(\)](#).

Here is the call graph for this function:



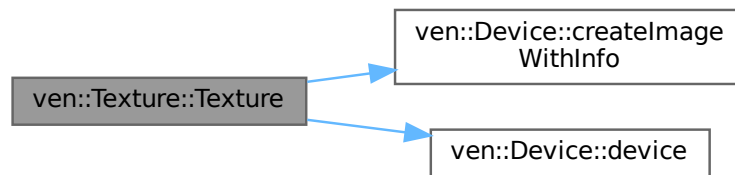
7.39.2.2 Texture() [2/3]

```
ven::Texture::Texture (
    Device & device,
    VkFormat format,
    VkExtent3D extent,
    VkImageUsageFlags usage,
    VkSampleCountFlagBits sampleCount)
```

Definition at line 14 of file [texture.cpp](#).

References [ven::Device::createImageWithInfo\(\)](#), [ven::Device::device\(\)](#), [m_descriptor](#), [m_textureImage](#), [m_textureImageMemory](#), [m_textureImageView](#), and [m_textureSampler](#).

Here is the call graph for this function:



7.39.2.3 ~Texture()

```
ven::Texture::~~Texture ()
```

Definition at line 88 of file [texture.cpp](#).

7.39.2.4 Texture() [3/3]

```
ven::Texture::Texture (
    const Texture & ) [delete]
```

7.39.3 Member Function Documentation

7.39.3.1 createTextureFromFile()

```
static std::unique_ptr< Texture > ven::Texture::createTextureFromFile (
    Device & device,
    const std::string & filepath) [inline], [static]
```

Definition at line 31 of file [Texture.hpp](#).

Referenced by [ven::SceneManager::SceneManager\(\)](#).

Here is the caller graph for this function:



7.39.3.2 createTextureImage()

```
void ven::Texture::createTextureImage (  
    const std::string & filepath) [private]
```

Definition at line 103 of file [texture.cpp](#).

Referenced by [Texture\(\)](#).

Here is the caller graph for this function:



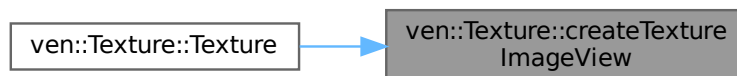
7.39.3.3 createTextureImageView()

```
void ven::Texture::createTextureImageView (  
    VkImageViewType viewType) [private]
```

Definition at line 190 of file [texture.cpp](#).

Referenced by [Texture\(\)](#).

Here is the caller graph for this function:



7.39.3.4 createTextureSampler()

```
void ven::Texture::createTextureSampler () [private]
```

Definition at line 208 of file [texture.cpp](#).

Referenced by [Texture\(\)](#).

Here is the caller graph for this function:



7.39.3.5 `getExtent()`

```
VkExtent3D ven::Texture::getExtent () const [inline], [nodiscard]
```

Definition at line 42 of file [Texture.hpp](#).

References [m_extent](#).

7.39.3.6 `getFormat()`

```
VkFormat ven::Texture::getFormat () const [inline], [nodiscard]
```

Definition at line 43 of file [Texture.hpp](#).

References [m_format](#).

7.39.3.7 `getImage()`

```
VkImage ven::Texture::getImage () const [inline], [nodiscard]
```

Definition at line 38 of file [Texture.hpp](#).

References [m_textureImage](#).

7.39.3.8 `getImageInfo()`

```
VkDescriptorImageInfo ven::Texture::getImageInfo () const [inline], [nodiscard]
```

Definition at line 40 of file [Texture.hpp](#).

References [m_descriptor](#).

7.39.3.9 `getImageLayout()`

```
VkImageLayout ven::Texture::getImageLayout () const [inline], [nodiscard]
```

Definition at line 41 of file [Texture.hpp](#).

References [m_textureLayout](#).

7.39.3.10 getImageView()

```
VkImageView ven::Texture::getImageView () const [inline], [nodiscard]
```

Definition at line 39 of file [Texture.hpp](#).

References [m_textureImageView](#).

7.39.3.11 imageView()

```
VkImageView ven::Texture::imageView () const [inline], [nodiscard]
```

Definition at line 36 of file [Texture.hpp](#).

References [m_textureImageView](#).

7.39.3.12 operator=()

```
Texture & ven::Texture::operator= (
    const Texture & ) [delete]
```

7.39.3.13 sampler()

```
VkSampler ven::Texture::sampler () const [inline], [nodiscard]
```

Definition at line 37 of file [Texture.hpp](#).

References [m_textureSampler](#).

7.39.3.14 transitionLayout()

```
void ven::Texture::transitionLayout (
    VkCommandBuffer commandBuffer,
    VkImageLayout oldLayout,
    VkImageLayout newLayout) const
```

Definition at line 238 of file [texture.cpp](#).

7.39.3.15 updateDescriptor()

```
void ven::Texture::updateDescriptor ()
```

Definition at line 96 of file [texture.cpp](#).

Referenced by [Texture\(\)](#).

Here is the caller graph for this function:



7.39.4 Member Data Documentation

7.39.4.1 m_descriptor

```
VkDescriptorImageInfo ven::Texture::m_descriptor {} [private]
```

Definition at line 51 of file [Texture.hpp](#).

Referenced by [getImageInfo\(\)](#), and [Texture\(\)](#).

7.39.4.2 m_device

```
Device& ven::Texture::m_device [private]
```

Definition at line 52 of file [Texture.hpp](#).

7.39.4.3 m_extent

```
VkExtent3D ven::Texture::m_extent {} [private]
```

Definition at line 61 of file [Texture.hpp](#).

Referenced by [getExtent\(\)](#).

7.39.4.4 m_format

```
VkFormat ven::Texture::m_format [private]
```

Definition at line 57 of file [Texture.hpp](#).

Referenced by [getFormat\(\)](#).

7.39.4.5 m_layerCount

```
uint32_t ven::Texture::m_layerCount {1} [private]
```

Definition at line 60 of file [Texture.hpp](#).

7.39.4.6 m_mipLevels

```
uint32_t ven::Texture::m_mipLevels {1} [private]
```

Definition at line 59 of file [Texture.hpp](#).

7.39.4.7 m_textureImage

```
VkImage ven::Texture::m_textureImage = nullptr [private]
```

Definition at line 53 of file [Texture.hpp](#).

Referenced by [getImage\(\)](#), and [Texture\(\)](#).

7.39.4.8 m_textureImageMemory

```
VkDeviceMemory ven::Texture::m_textureImageMemory = nullptr [private]
```

Definition at line 54 of file [Texture.hpp](#).

Referenced by [Texture\(\)](#).

7.39.4.9 m_textureImageView

```
VkImageView ven::Texture::m_textureImageView = nullptr [private]
```

Definition at line 55 of file [Texture.hpp](#).

Referenced by [getImageView\(\)](#), [imageView\(\)](#), and [Texture\(\)](#).

7.39.4.10 m_textureLayout

```
VkImageLayout ven::Texture::m_textureLayout {} [private]
```

Definition at line 58 of file [Texture.hpp](#).

Referenced by [getImageLayout\(\)](#).

7.39.4.11 m_textureSampler

```
VkSampler ven::Texture::m_textureSampler = nullptr [private]
```

Definition at line 56 of file [Texture.hpp](#).

Referenced by [sampler\(\)](#), and [Texture\(\)](#).

The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Texture.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/texture.cpp](#)

7.40 ven::Transform3D Class Reference

Class for 3D transformation.

```
#include <Transform3D.hpp>
```

Collaboration diagram for ven::Transform3D:

ven::Transform3D
+ translation
+ scale
+ rotation
+ transformMatrix()
+ normalMatrix()

Public Member Functions

- glm::mat4 [transformMatrix](#) () const
- glm::mat3 [normalMatrix](#) () const

Public Attributes

- glm::vec3 [translation](#) {}
- glm::vec3 [scale](#) {1.F, 1.F, 1.F}
- glm::vec3 [rotation](#) {}

7.40.1 Detailed Description

Class for 3D transformation.

Definition at line 18 of file [Transform3D.hpp](#).

7.40.2 Member Function Documentation

7.40.2.1 normalMatrix()

```
glm::mat3 ven::Transform3D::normalMatrix () const [inline], [nodiscard]
```

Definition at line 34 of file [Transform3D.hpp](#).

References [transformMatrix\(\)](#).

Here is the call graph for this function:



7.40.2.2 transformMatrix()

```
glm::mat4 ven::Transform3D::transformMatrix () const [inline], [nodiscard]
```

Definition at line 22 of file [Transform3D.hpp](#).

References [rotation](#), [scale](#), and [translation](#).

Referenced by [normalMatrix\(\)](#).

Here is the caller graph for this function:



7.40.3 Member Data Documentation

7.40.3.1 rotation

```
glm::vec3 ven::Transform3D::rotation {}
```

Definition at line 38 of file [Transform3D.hpp](#).

Referenced by [ven::Gui::cameraSection\(\)](#), [ven::EventManager::moveCamera\(\)](#), and [transformMatrix\(\)](#).

7.40.3.2 scale

```
glm::vec3 ven::Transform3D::scale {1.F, 1.F, 1.F}
```

Definition at line 37 of file [Transform3D.hpp](#).

Referenced by [ven::SceneManager::createLight\(\)](#), [ven::SceneManager::duplicateLight\(\)](#), and [transformMatrix\(\)](#).

7.40.3.3 translation

```
glm::vec3 ven::Transform3D::translation {}
```

Definition at line 36 of file [Transform3D.hpp](#).

Referenced by [ven::Gui::cameraSection\(\)](#), [ven::EventManager::moveCamera\(\)](#), and [transformMatrix\(\)](#).

The documentation for this class was generated from the following file:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Scene/Transform3D.hpp](#)

7.41 ven::Model::Vertex Struct Reference

```
#include <Model.hpp>
```

Collaboration diagram for ven::Model::Vertex:

ven::Model::Vertex
+ position
+ color
+ normal
+ uv
+ operator==()
+ getBindingDescriptions()
+ getAttributeDescriptions()

Public Member Functions

- bool [operator==](#) (const [Vertex](#) &other) const

Static Public Member Functions

- static `std::vector< VkVertexInputBindingDescription >` [getBindingDescriptions](#) ()
- static `std::vector< VkVertexInputAttributeDescription >` [getAttributeDescriptions](#) ()

Public Attributes

- `glm::vec3` [position](#) {}
- `glm::vec3` [color](#) {}
- `glm::vec3` [normal](#) {}
- `glm::vec2` [uv](#) {}

7.41.1 Detailed Description

Definition at line 28 of file [Model.hpp](#).

7.41.2 Member Function Documentation

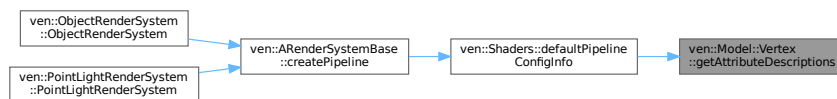
7.41.2.1 [getAttributeDescriptions\(\)](#)

```
std::vector< VkVertexInputAttributeDescription > ven::Model::Vertex::getAttributeDescriptions
() [static]
```

Definition at line 100 of file [model.cpp](#).

Referenced by [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

Here is the caller graph for this function:



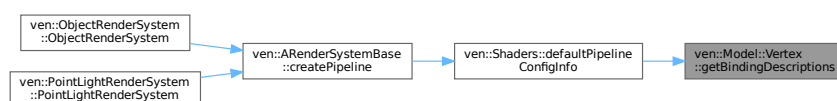
7.41.2.2 [getBindingDescriptions\(\)](#)

```
std::vector< VkVertexInputBindingDescription > ven::Model::Vertex::getBindingDescriptions
() [static]
```

Definition at line 91 of file [model.cpp](#).

Referenced by [ven::Shaders::defaultPipelineConfigInfo\(\)](#).

Here is the caller graph for this function:



7.41.2.3 operator==()

```
bool ven::Model::Vertex::operator== (
    const Vertex & other) const [inline]
```

Definition at line 37 of file [Model.hpp](#).

References [color](#), [normal](#), [position](#), and [uv](#).

7.41.3 Member Data Documentation

7.41.3.1 color

```
glm::vec3 ven::Model::Vertex::color {}
```

Definition at line 30 of file [Model.hpp](#).

Referenced by [operator==\(\)](#).

7.41.3.2 normal

```
glm::vec3 ven::Model::Vertex::normal {}
```

Definition at line 31 of file [Model.hpp](#).

Referenced by [operator==\(\)](#).

7.41.3.3 position

```
glm::vec3 ven::Model::Vertex::position {}
```

Definition at line 29 of file [Model.hpp](#).

Referenced by [operator==\(\)](#), and [ven::Model::Builder::processMesh\(\)](#).

7.41.3.4 uv

```
glm::vec2 ven::Model::Vertex::uv {}
```

Definition at line 32 of file [Model.hpp](#).

Referenced by [operator==\(\)](#).

The documentation for this struct was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Model.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Gfx/model.cpp](#)

7.42 ven::Window Class Reference

Class for window.

```
#include <Window.hpp>
```

Collaboration diagram for ven::Window:

ven::Window
<ul style="list-style-type: none"> - m_window - m_width - m_height - m_framebufferResized
<ul style="list-style-type: none"> + Window() + ~Window() + Window() + operator=() + createWindow() + createWindowSurface() + getGLFWWindow() + getExtent() + wasWindowResized() + resetWindowResizedFlag() + setFullscreen() - framebufferResizeCallback()

Public Member Functions

- [Window](#) (const uint32_t width=[DEFAULT_WIDTH](#), const uint32_t height=[DEFAULT_HEIGHT](#), const std::string &title=[DEFAULT_TITLE](#).data())
- [~Window](#) ()
- [Window](#) (const [Window](#) &)=delete
- [Window](#) & [operator=](#) (const [Window](#) &)=delete
- GLFWwindow * [createWindow](#) (uint32_t width, uint32_t height, const std::string &title)
- void [createWindowSurface](#) (VkInstance instance, VkSurfaceKHR *surface) const
- GLFWwindow * [getGLFWWindow](#) () const
- VkExtent2D [getExtent](#) () const
- bool [wasWindowResized](#) () const
- void [resetWindowResizedFlag](#) ()
- void [setFullscreen](#) (bool fullscreen, uint32_t width, uint32_t height)

Static Private Member Functions

- static void [framebufferResizeCallback](#) (GLFWwindow *window, int width, int height)

Private Attributes

- GLFWwindow * [m_window](#) {nullptr}
- uint32_t [m_width](#) {DEFAULT_WIDTH}
- uint32_t [m_height](#) {DEFAULT_HEIGHT}
- bool [m_framebufferResized](#) = false

7.42.1 Detailed Description

Class for window.

Definition at line 26 of file [Window.hpp](#).

7.42.2 Constructor & Destructor Documentation

7.42.2.1 Window() [1/2]

```
ven::Window::Window (
    const uint32_t width = DEFAULT\_WIDTH,
    const uint32_t height = DEFAULT\_HEIGHT,
    const std::string & title = DEFAULT\_TITLE.data()) [inline], [explicit]
```

Definition at line 30 of file [Window.hpp](#).

7.42.2.2 ~Window()

```
ven::Window::~~Window () [inline]
```

Definition at line 31 of file [Window.hpp](#).

References [m_window](#).

7.42.2.3 Window() [2/2]

```
ven::Window::Window (
    const Window & ) [delete]
```

7.42.3 Member Function Documentation

7.42.3.1 `createWindow()`

```
GLFWwindow * ven::Window::createWindow (
    uint32_t width,
    uint32_t height,
    const std::string & title) [nodiscard]
```

Definition at line 5 of file [window.cpp](#).

References [framebufferResizeCallback\(\)](#).

Here is the call graph for this function:



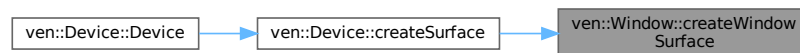
7.42.3.2 `createWindowSurface()`

```
void ven::Window::createWindowSurface (
    VkInstance instance,
    VkSurfaceKHR * surface) const
```

Definition at line 24 of file [window.cpp](#).

Referenced by [ven::Device::createSurface\(\)](#).

Here is the caller graph for this function:



7.42.3.3 framebufferResizeCallback()

```
void ven::Window::framebufferResizeCallback (  
    GLFWwindow * window,  
    int width,  
    int height) [static], [private]
```

Definition at line 31 of file [window.cpp](#).

References [m_framebufferResized](#).

Referenced by [createWindow\(\)](#).

Here is the caller graph for this function:



7.42.3.4 getExtent()

```
VkExtent2D ven::Window::getExtent () const [inline], [nodiscard]
```

Definition at line 41 of file [Window.hpp](#).

References [m_height](#), and [m_width](#).

Referenced by [ven::Gui::renderSection\(\)](#).

Here is the caller graph for this function:



7.42.3.5 getGLFWWindow()

```
GLFWwindow * ven::Window::getGLFWWindow () const [inline], [nodiscard]
```

Definition at line 39 of file [Window.hpp](#).

References [m_window](#).

Referenced by [ven::Engine::Engine\(\)](#).

Here is the caller graph for this function:



7.42.3.6 operator=()

```
Window & ven::Window::operator= (
    const Window & ) [delete]
```

7.42.3.7 resetWindowResizedFlag()

```
void ven::Window::resetWindowResizedFlag () [inline]
```

Definition at line 43 of file [Window.hpp](#).

References [m_framebufferResized](#).

7.42.3.8 setFullscreen()

```
void ven::Window::setFullscreen (
    bool fullscreen,
    uint32_t width,
    uint32_t height)
```

Definition at line 39 of file [window.cpp](#).

Referenced by [ven::Gui::renderSection\(\)](#).

Here is the caller graph for this function:



7.42.3.9 wasWindowResized()

```
bool ven::Window::wasWindowResized () const [inline], [nodiscard]
```

Definition at line 42 of file [Window.hpp](#).

References [m_framebufferResized](#).

7.42.4 Member Data Documentation

7.42.4.1 m_framebufferResized

```
bool ven::Window::m_framebufferResized = false [private]
```

Definition at line 55 of file [Window.hpp](#).

Referenced by [framebufferResizeCallback\(\)](#), [resetWindowResizedFlag\(\)](#), and [wasWindowResized\(\)](#).

7.42.4.2 m_height

```
uint32_t ven::Window::m_height {DEFAULT_HEIGHT} [private]
```

Definition at line 53 of file [Window.hpp](#).

Referenced by [getExtent\(\)](#).

7.42.4.3 m_width

```
uint32_t ven::Window::m_width {DEFAULT_WIDTH} [private]
```

Definition at line 52 of file [Window.hpp](#).

Referenced by [getExtent\(\)](#).

7.42.4.4 m_window

```
GLFWwindow* ven::Window::m_window {nullptr} [private]
```

Definition at line 51 of file [Window.hpp](#).

Referenced by [getGLFWWindow\(\)](#), and [~Window\(\)](#).

The documentation for this class was generated from the following files:

- [/home/runner/work/VEngine/VEngine/include/VEngine/Core/Window.hpp](#)
- [/home/runner/work/VEngine/VEngine/src/Core/window.cpp](#)

Chapter 8

File Documentation

8.1 [/home/runner/work/VEngine/VEngine/assets/shaders/fragment_↵](#) point_light.frag File Reference

8.2 fragment_point_light.frag

[Go to the documentation of this file.](#)

```
00001 #version 450
00002
00003 layout(location = 0) in vec2 fragOffset;
00004 layout(location = 0) out vec4 outColor;
00005
00006 struct PointLight {
00007     vec4 position; // ignore w
00008     vec4 color; // w is intensity
00009     float shininess;
00010 };
00011
00012 layout(set = 0, binding = 0) uniform GlobalUbo {
00013     mat4 projection;
00014     mat4 view;
00015     mat4 invView;
00016     vec4 ambientLightColor; // w is intensity
00017     PointLight pointLights[10];
00018     int numLights;
00019 } ubo;
00020
00021 layout(push_constant) uniform Push {
00022     vec4 position;
00023     vec4 color;
00024     float radius;
00025 } push;
00026
00027 const float M_PI = 3.1415926538;
00028
00029 void main() {
00030     float dis = length(fragOffset);
00031     if (dis >= 1.0) {
00032         discard;
00033     }
00034
00035     float cosDis = 0.5 * (cos(dis * M_PI) + 1.0);
00036     outColor = vec4(push.color.rgb + 0.5 * cosDis, cosDis);
00037 }
```

8.3 [/home/runner/work/VEngine/VEngine/assets/shaders/fragment_↵](#) shader.frag File Reference

8.4 fragment_shader.frag

[Go to the documentation of this file.](#)

```

00001 #version 450
00002
00003 layout(location = 0) in vec3 fragColor;
00004 layout(location = 1) in vec3 fragPosWorld;
00005 layout(location = 2) in vec3 fragNormalWorld;
00006 layout(location = 3) in vec2 fragUv;
00007
00008 layout(location = 0) out vec4 outColor;
00009
00010 struct PointLight {
00011     vec4 position; // ignore w
00012     vec4 color; // w is intensity
00013     float shininess;
00014 };
00015
00016 layout(set = 0, binding = 0) uniform GlobalUbo {
00017     mat4 projection;
00018     mat4 view;
00019     mat4 invView;
00020     vec4 ambientLightColor; // w is intensity
00021     PointLight pointLights[10];
00022     int numLights;
00023 } ubo;
00024
00025 layout(set = 1, binding = 1) uniform sampler2D diffuseMap;
00026
00027 layout(push_constant) uniform Push {
00028     mat4 modelMatrix;
00029     mat4 normalMatrix;
00030 } push;
00031
00032 void main() {
00033     vec3 specularLight = vec3(0.0);
00034     vec3 surfaceNormal = normalize(gl_FrontFacing ? fragNormalWorld : -fragNormalWorld);
00035     vec3 diffuseLight = ubo.ambientLightColor.rgb * ubo.ambientLightColor.a;
00036
00037     vec3 cameraPosWorld = ubo.invView[3].xyz;
00038     vec3 viewDirection = normalize(cameraPosWorld - fragPosWorld);
00039
00040     for (int i = 0; i < ubo.numLights; i++) {
00041         PointLight light = ubo.pointLights[i];
00042         vec3 directionToLight = light.position.xyz - fragPosWorld;
00043         float distanceSquared = dot(directionToLight, directionToLight);
00044         float attenuation = distanceSquared > 0.001 ? (light.position.w + 1.0) / distanceSquared : 0.0;
00045         directionToLight = normalize(directionToLight);
00046
00047         float cosAngIncidence = max(dot(surfaceNormal, directionToLight), 0);
00048         vec3 intensity = light.color.rgb * light.color.a * attenuation;
00049
00050         if (cosAngIncidence > 0) {
00051             vec3 halfVector = normalize(directionToLight + viewDirection);
00052             float cosAngHalf = max(dot(surfaceNormal, halfVector), 0);
00053
00054             float specular = pow(cosAngHalf, light.shininess);
00055
00056             diffuseLight += intensity * cosAngIncidence;
00057             specularLight += intensity * specular;
00058         }
00059     }
00060
00061     vec3 color = texture(diffuseMap, fragUv).xyz;
00062     outColor = vec4(diffuseLight * color + specularLight, 1.0);
00063 }

```

8.5 /home/runner/work/VEngine/VEngine/assets/shaders/vertex_point_↵ light.vert File Reference

8.6 vertex_point_light.vert

[Go to the documentation of this file.](#)

```

00001 #version 450
00002
00003 const vec2 OFFSETS[6] = vec2[](
00004     vec2(-1.0, -1.0),
00005     vec2(-1.0, 1.0),
00006     vec2(1.0, -1.0),
00007     vec2(1.0, 1.0),

```



```

00008 vec2(-1.0, 1.0),
00009 vec2(1.0, 1.0)
00010 );
00011
00012 layout(location = 0) out vec2 fragOffset;
00013
00014 struct PointLight {
00015     vec4 position; // ignore w
00016     vec4 color; // w is intensity
00017     float shininess;
00018 };
00019
00020 layout(set = 0, binding = 0) uniform GlobalUbo {
00021     mat4 projection;
00022     mat4 view;
00023     mat4 invView;
00024     vec4 ambientLightColor; // w is intensity
00025     PointLight pointLights[10];
00026     int numLights;
00027 } ubo;
00028
00029 layout(push_constant) uniform Push {
00030     vec4 position;
00031     vec4 color;
00032     float radius;
00033 } push;
00034
00035 void main() {
00036     fragOffset = OFFSETS[gl_VertexIndex];
00037     vec3 cameraRightWorld = vec3(ubo.view[0][0], ubo.view[1][0], ubo.view[2][0]);
00038     vec3 cameraUpWorld = vec3(ubo.view[0][1], ubo.view[1][1], ubo.view[2][1]);
00039
00040     vec3 positionWorld = push.position.xyz
00041     + push.radius * fragOffset.x * cameraRightWorld
00042     + push.radius * fragOffset.y * cameraUpWorld;
00043
00044     gl_Position = ubo.projection * ubo.view * vec4(positionWorld, 1.0);
00045 }

```

8.7 /home/runner/work/VEngine/VEngine/assets/shaders/vertex_shader.vert File Reference

8.8 vertex_shader.vert

[Go to the documentation of this file.](#)

```

00001 #version 450
00002
00003 layout(location = 0) in vec3 position;
00004 layout(location = 1) in vec3 color;
00005 layout(location = 2) in vec3 normal;
00006 layout(location = 3) in vec2 uv;
00007
00008 layout(location = 0) out vec3 fragColor;
00009 layout(location = 1) out vec3 fragPosWorld;
00010 layout(location = 2) out vec3 fragNormalWorld;
00011 layout(location = 3) out vec2 fragUv;
00012
00013 struct PointLight {
00014     vec4 position; // ignore w
00015     vec4 color; // w is intensity
00016     float shininess;
00017 };
00018
00019 layout(set = 0, binding = 0) uniform GlobalUbo {
00020     mat4 projection;
00021     mat4 view;
00022     mat4 invView;
00023     vec4 ambientLightColor; // w is intensity
00024     PointLight pointLights[10];
00025     int numLights;
00026 } ubo;
00027
00028 layout(set = 1, binding = 0) uniform ObjectBufferData {
00029     mat4 modelMatrix;
00030     mat4 normalMatrix;
00031 } object;
00032

```

```

00033 layout(push_constant) uniform Push {
00034     mat4 modelMatrix;
00035     mat4 normalMatrix;
00036 } push;
00037
00038 void main() {
00039     vec4 positionWorld = object.modelMatrix * vec4(position, 1.0);
00040     gl_Position = ubo.projection * ubo.view * positionWorld;
00041     fragNormalWorld = normalize(mat3(object.normalMatrix) * normal);
00042     fragPosWorld = positionWorld.xyz;
00043     fragColor = color;
00044     fragUv = uv;
00045 }

```

8.9 /home/runner/work/VEngine/VEngine/include/VEngine/Core/↵ Device.hpp File Reference

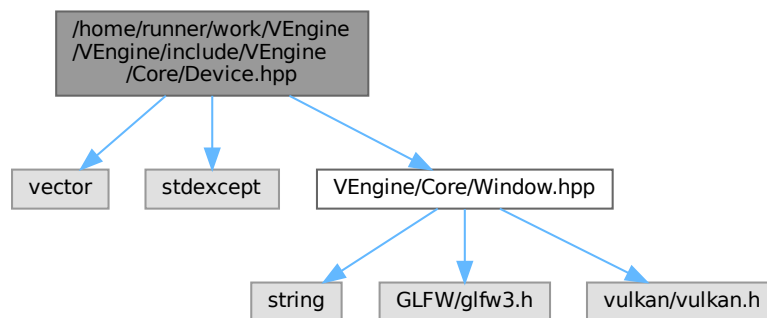
This file contains the Device class.

```

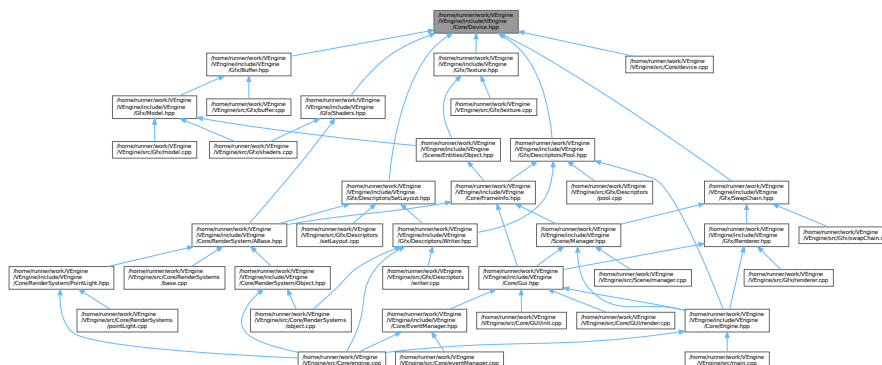
#include <vector>
#include <stdexcept>
#include "VEngine/Core/Window.hpp"

```

Include dependency graph for Device.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct [ven::SwapChainSupportDetails](#)
- struct [ven::QueueFamilyIndices](#)
- class [ven::Device](#)

Class for device.

Namespaces

- namespace [ven](#)

8.9.1 Detailed Description

This file contains the Device class.

Definition in file [Device.hpp](#).

8.10 Device.hpp

[Go to the documentation of this file.](#)

```
00001 ///
00002 /// @file Device.hpp
00003 /// @brief This file contains the Device class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <vector>
00010 #include <stdexcept>
00011
00012 #include "VEngine/Core/Window.hpp"
00013
00014 namespace ven {
00015
00016     struct SwapChainSupportDetails {
00017         VkSurfaceCapabilitiesKHR capabilities;
00018         std::vector<VkSurfaceFormatKHR> formats;
00019         std::vector<VkPresentModeKHR> presentModes;
00020     };
00021
00022     struct QueueFamilyIndices {
00023         uint32_t graphicsFamily{};
00024         uint32_t presentFamily{};
00025         bool graphicsFamilyHasValue = false;
00026         bool presentFamilyHasValue = false;
00027         [[nodiscard]] bool isComplete() const { return graphicsFamilyHasValue &&
presentFamilyHasValue; }
00028     };
00029
00030     ///
00031     /// @class Device
00032     /// @brief Class for device
00033     /// @namespace ven
00034     ///
00035     class Device {
00036
00037     public:
00038
00039         #ifndef NDEBUG
00040             const bool enableValidationLayers = false;
00041         #else
00042             const bool enableValidationLayers = true;
00043         #endif
00044
00045         explicit Device(Window &window);
00046         ~Device();
00047
00048         Device(const Device&) = delete;
```

```

00049         Device& operator=(const Device&) = delete;
00050
00051         [[nodiscard]] VkCommandPool getCommandPool() const { return m_commandPool; }
00052         [[nodiscard]] VkDevice device() const { return m_device; }
00053         [[nodiscard]] VkSurfaceKHR surface() const { return m_surface; }
00054         [[nodiscard]] VkQueue graphicsQueue() const { return m_graphicsQueue; }
00055         [[nodiscard]] VkQueue presentQueue() const { return m_presentQueue; }
00056
00057         [[nodiscard]] SwapChainSupportDetails getSwapChainSupport() const { return
querySwapChainSupport(m_physicalDevice); }
00058         [[nodiscard]] uint32_t findMemoryType(uint32_t typeFilter, VkMemoryPropertyFlags
properties) const;
00059         [[nodiscard]] QueueFamilyIndices findPhysicalQueueFamilies() const { return
findQueueFamilies(m_physicalDevice); }
00060         [[nodiscard]] VkPhysicalDevice getPhysicalDevice() const { return m_physicalDevice; }
00061         [[nodiscard]] VkQueue getGraphicsQueue() const { return m_graphicsQueue; }
00062         [[nodiscard]] VkFormat findSupportedFormat(const std::vector<VkFormat> &candidates,
VkImageTiling, VkFormatFeatureFlags features) const;
00063         [[nodiscard]] VkPhysicalDeviceProperties getProperties() const { return m_properties; }
00064         [[nodiscard]] VkInstance getInstance() const { return m_instance; }
00065
00066         // Buffer Helper Functions
00067         void createBuffer(VkDeviceSize size, VkBufferUsageFlags usage, VkMemoryPropertyFlags
properties,
VkBuffer &buffer, VkDeviceMemory &bufferMemory) const;
00068         [[nodiscard]] VkCommandBuffer beginSingleTimeCommands() const;
00069         void endSingleTimeCommands(VkCommandBuffer commandBuffer) const;
00070         void copyBuffer(VkBuffer srcBuffer, VkBuffer dstBuffer, VkDeviceSize size) const;
00071         void copyBufferToImage(VkBuffer buffer, VkImage image, uint32_t width, uint32_t height,
uint32_t layerCount) const;
00072
00073         void createImageWithInfo(const VkImageCreateInfo &imageInfo, VkMemoryPropertyFlags
properties,
VkImage &image, VkDeviceMemory &imageMemory) const;
00074         void transitionImageLayout(VkImage image, VkFormat format, VkImageLayout oldLayout,
VkImageLayout newLayout, uint32_t mipLevels = 1, uint32_t layerCount = 1) const;
00075
00076     private:
00077
00078         void createInstance();
00079         void setupDebugMessenger();
00080         void createSurface() { m_window.createWindowSurface(m_instance, &m_surface); };
00081         void pickPhysicalDevice();
00082         void createLogicalDevice();
00083         void createCommandPool();
00084
00085         // helper functions
00086         bool isDeviceSuitable(VkPhysicalDevice device) const;
00087         [[nodiscard]] std::vector<const char *> getRequiredExtensions() const;
00088         [[nodiscard]] bool checkValidationLayerSupport() const;
00089         QueueFamilyIndices findQueueFamilies(VkPhysicalDevice device) const;
00090         static void populateDebugMessengerCreateInfo(VkDebugUtilsMessengerCreateInfoEXT
&createInfo);
00091         void hasGlfwRequiredInstanceExtensions() const;
00092         bool checkDeviceExtensionSupport(VkPhysicalDevice device) const;
00093         SwapChainSupportDetails querySwapChainSupport(VkPhysicalDevice device) const;
00094
00095         Window &m_window;
00096         VkDebugUtilsMessengerEXT m_debugMessenger;
00097         VkPhysicalDevice m_physicalDevice = VK_NULL_HANDLE;
00098         VkCommandPool m_commandPool;
00099         VkDevice m_device;
00100         VkInstance m_instance;
00101         VkSurfaceKHR m_surface;
00102         VkQueue m_graphicsQueue;
00103         VkQueue m_presentQueue;
00104         VkPhysicalDeviceProperties m_properties;
00105
00106         const std::vector<const char *> m_validationLayers = {"VK_LAYER_KHRONOS_validation"};
00107         const std::vector<const char *> m_deviceExtensions = {VK_KHR_SWAPCHAIN_EXTENSION_NAME};
00108
00109     }; // class Device
00110
00111 } // namespace ven

```

8.11 /home/runner/work/VEngine/VEngine/include/VEngine/Core/Engine.hpp File Reference

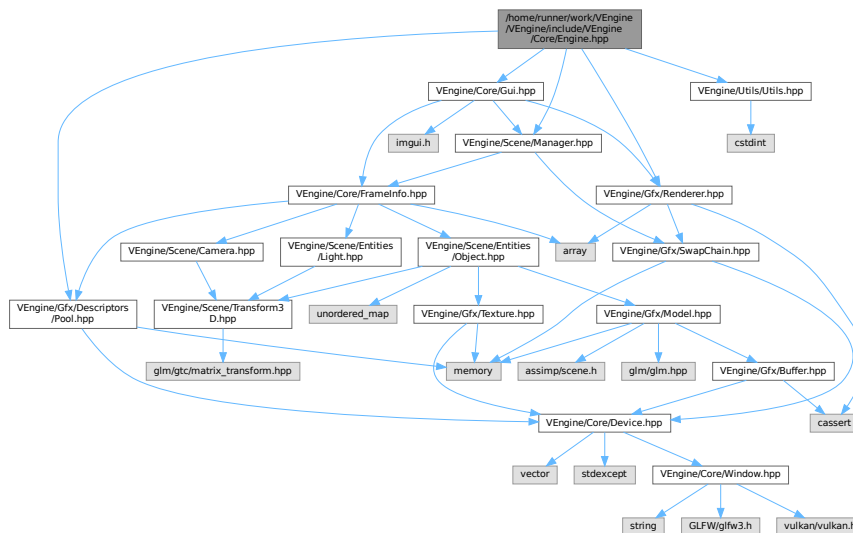
This file contains the Engine class.

```

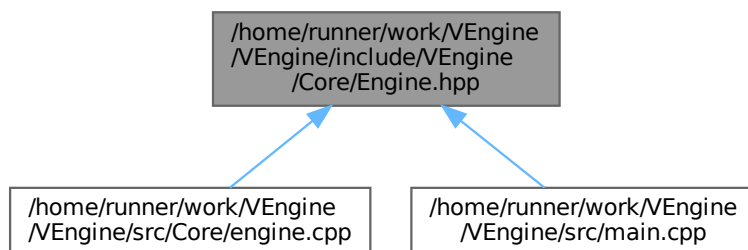
#include "VEngine/Core/Gui.hpp"
#include "VEngine/Gfx/Renderer.hpp"

```

```
#include "VEngine/Gfx/Descriptors/Pool.hpp"
#include "VEngine/Scene/Manager.hpp"
#include "VEngine/Utils/Utils.hpp"
Include dependency graph for Engine.hpp:
```



This graph shows which files directly or indirectly include this file:



Classes

- class `ven::Engine`
Class for engine.

Namespaces

- namespace **ven**

8.11.1 Detailed Description

This file contains the Engine class.

Definition in file [Engine.hpp](#).

8.12 Engine.hpp

[Go to the documentation of this file.](#)

```

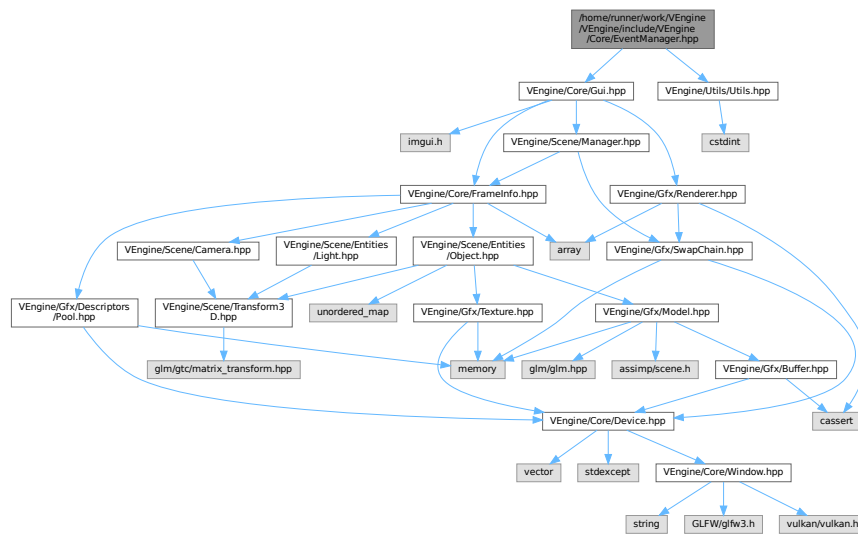
00001 ///
00002 /// @file Engine.hpp
00003 /// @brief This file contains the Engine class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include "VEngine/Core/Gui.hpp"
00010 #include "VEngine/Gfx/Renderer.hpp"
00011 #include "VEngine/Gfx/Descriptors/Pool.hpp"
00012 #include "VEngine/Scene/Manager.hpp"
00013 #include "VEngine/Utils/Utils.hpp"
00014
00015 namespace ven {
00016
00017
00018     ///
00019     /// @class Engine
00020     /// @brief Class for engine
00021     /// @namespace ven
00022     ///
00023     class Engine {
00024
00025     public:
00026
00027         explicit Engine(uint32_t = DEFAULT_WIDTH, uint32_t = DEFAULT_HEIGHT, const std::string
&title = DEFAULT_TITLE.data());
00028         ~Engine() = default;
00029
00030         Engine(const Engine&) = delete;
00031         Engine operator=(const Engine&) = delete;
00032
00033         void mainLoop();
00034
00035         void cleanup();
00036
00037     private:
00038
00039         void loadObjects();
00040
00041         ENGINE_STATE m_state{EXIT};
00042
00043         Window m_window;
00044         Device m_device{m_window};
00045         Renderer m_renderer{m_window, m_device};
00046         Gui m_gui;
00047         std::unique_ptr<DescriptorPool> m_globalPool;
00048         std::vector<std::unique_ptr<DescriptorPool>> m_framePools;
00049         SceneManager m_sceneManager{m_device};
00050
00051     }; // class Engine
00052
00053 } // namespace ven

```

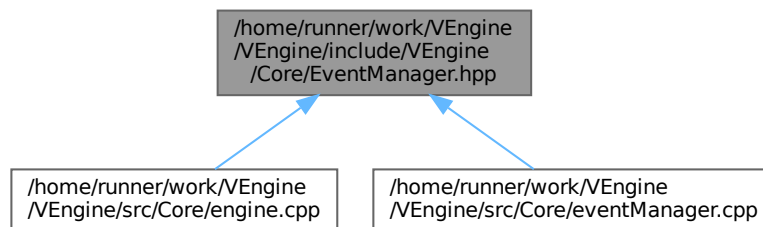
8.13 /home/runner/work/VEngine/VEngine/include/VEngine/Core/EventManager.hpp File Reference

This file contains the EventManager class.

```
#include "VEngine/Core/Gui.hpp"
#include "VEngine/Utils/Utils.hpp"
Include dependency graph for EventManager.hpp:
```



This graph shows which files directly or indirectly include this file:



Classes

- struct [ven::KeyAction](#)
- struct [ven::KeyMappings](#)
- class [ven::EventManager](#)

Class for event manager.

Namespaces

- namespace [ven](#)

Variables

- static constexpr float [ven::EPSILON](#) = std::numeric_limits<float>::epsilon()
- static constexpr [KeyMappings](#) [ven::DEFAULT_KEY_MAPPINGS](#) {}

8.13.1 Detailed Description

This file contains the EventManager class.

Definition in file [EventManager.hpp](#).

8.14 EventManager.hpp

[Go to the documentation of this file.](#)

```
00001 ///
00002 /// @file EventManager.hpp
00003 /// @brief This file contains the EventManager class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include "VEngine/Core/Gui.hpp"
00010 #include "VEngine/Utils/Utils.hpp"
00011
00012 namespace ven {
00013
00014     struct KeyAction {
00015         uint16_t key;
00016         glm::vec3* dir;
00017         glm::vec3 value;
00018     };
00019
00020     struct KeyMappings {
00021         uint16_t moveLeft = GLFW_KEY_A;
00022         uint16_t moveRight = GLFW_KEY_D;
00023         uint16_t moveForward = GLFW_KEY_W;
00024         uint16_t moveBackward = GLFW_KEY_S;
00025         uint16_t moveUp = GLFW_KEY_SPACE;
00026         uint16_t moveDown = GLFW_KEY_LEFT_SHIFT;
00027         uint16_t lookLeft = GLFW_KEY_LEFT;
00028         uint16_t lookRight = GLFW_KEY_RIGHT;
00029         uint16_t lookUp = GLFW_KEY_UP;
00030         uint16_t lookDown = GLFW_KEY_DOWN;
00031         uint16_t toggleGui = GLFW_KEY_0;
00032     };
00033
00034     static constexpr float EPSILON = std::numeric_limits<float>::epsilon();
00035     static constexpr KeyMappings DEFAULT_KEY_MAPPINGS{};
00036
00037     ///
00038     /// @class EventManager
00039     /// @brief Class for event manager
00040     /// @namespace ven
00041     ///
00042     class EventManager {
00043     public:
00044
00045         EventManager() = default;
00046         ~EventManager() = default;
00047
00048         EventManager(const EventManager&) = delete;
00049         EventManager& operator=(const EventManager&) = delete;
00050
00051         void handleEvents(GLFWwindow* window, ENGINE_STATE* engineState, Camera& camera, Gui& gui,
00052             float dt) const;
00053
00054     private:
00055
00056         static void moveCamera(GLFWwindow* window, Camera& camera, float dt);
00057         static void updateEngineState(ENGINE_STATE* engineState, const ENGINE_STATE newState) {
00058             *engineState = newState; }
00059         static bool isKeyJustPressed(GLFWwindow* window, long unsigned int key, std::array<bool,
00060             GLFW_KEY_LAST>& keyStates);
00061
00062         template<typename Iterator>
00063         static void processKeyActions(GLFWwindow* window, Iterator begin, Iterator end);
00064
00065         mutable std::array<bool, GLFW_KEY_LAST> m_keyState{};
00066
00067     }; // class EventManager
00068 } // namespace ven
```


Variables

- static constexpr float `ven::DEFAULT_AMBIENT_LIGHT_INTENSITY` = .2F
- static constexpr glm::vec4 `ven::DEFAULT_AMBIENT_LIGHT_COLOR` = {glm::vec3(1.F), `DEFAULT_AMBIENT_LIGHT_INTENSITY`}

8.15.1 Detailed Description

This file contains the `FrameInfo` class.

Definition in file [FrameInfo.hpp](#).

8.16 FrameInfo.hpp

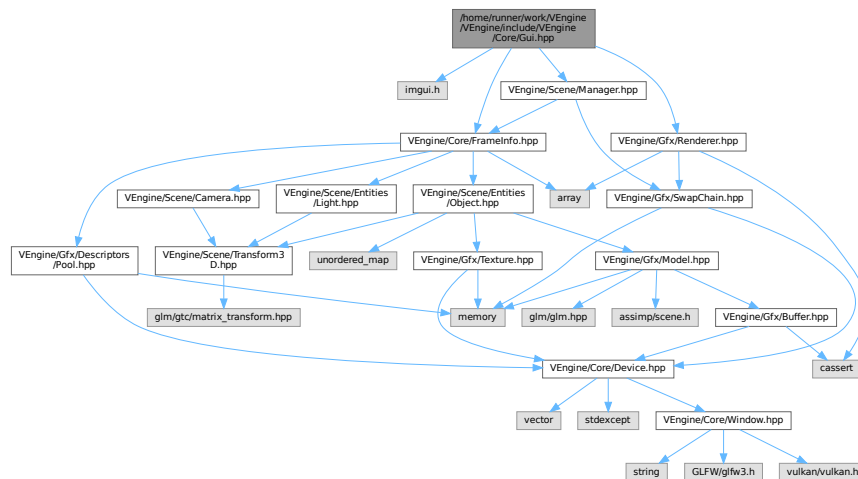
[Go to the documentation of this file.](#)

```
00001 ///
00002 /// @file FrameInfo.hpp
00003 /// @brief This file contains the FrameInfo class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <array>
00010
00011 #include "VEngine/Gfx/Descriptors/Pool.hpp"
00012 #include "VEngine/Scene/Camera.hpp"
00013 #include "VEngine/Scene/Entities/Object.hpp"
00014 #include "VEngine/Scene/Entities/Light.hpp"
00015
00016 namespace ven {
00017
00018 static constexpr float DEFAULT_AMBIENT_LIGHT_INTENSITY = .2F;
00019 static constexpr glm::vec4 DEFAULT_AMBIENT_LIGHT_COLOR = {glm::vec3(1.F),
00020   DEFAULT_AMBIENT_LIGHT_INTENSITY};
00021
00022 struct PointLightData
00023 {
00024     glm::vec4 position{};
00025     glm::vec4 color{};
00026     float shininess{32.F};
00027     float padding[3]; // Pad to 32 bytes
00028 };
00029
00030 struct ObjectBufferData {
00031     glm::mat4 modelMatrix{1.F};
00032     glm::mat4 normalMatrix{1.F};
00033 };
00034
00035 struct GlobalUbo
00036 {
00037     glm::mat4 projection{1.F};
00038     glm::mat4 view{1.F};
00039     glm::mat4 inverseView{1.F};
00040     glm::vec4 ambientLightColor{DEFAULT_AMBIENT_LIGHT_COLOR};
00041     std::array<PointLightData, MAX_LIGHTS> pointLights;
00042     uint8_t numLights;
00043 };
00044
00045 struct FrameInfo
00046 {
00047     unsigned long frameIndex;
00048     float frameTime;
00049     VkCommandBuffer commandBuffer;
00050     Camera &camera;
00051     VkDescriptorSet globalDescriptorSet;
00052     DescriptorPool &frameDescriptorPool;
00053     Object::Map &objects;
00054     Light::Map &lights;
00055 };
00056 } // namespace ven
```

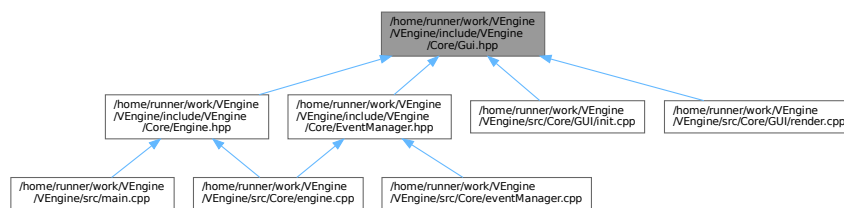
8.17 /home/runner/work/VEngine/VEngine/include/VEngine/Core/Gui.hpp File Reference

This file contains the ImGuiWindowManager class.

```
#include <imgui.h>
#include "VEngine/Core/FrameInfo.hpp"
#include "VEngine/Scene/Manager.hpp"
#include "VEngine/Gfx/Renderer.hpp"
Include dependency graph for Gui.hpp:
```



This graph shows which files directly or indirectly include this file:



Classes

- class [ven::Gui](#)
Class for *Gui*.
- struct [ven::Gui::ClockData](#)
- struct [ven::Gui::funcs](#)

Namespaces

- namespace [ven](#)

Enumerations

- enum `ven::GUI_STATE` : `uint8_t` { `ven::SHOW_EDITOR` = 0 , `ven::SHOW_PLAYER` = 1 , `ven::HIDDEN` = 2 }

Variables

- static constexpr `uint16_t` `ven::DESCRIPTOR_COUNT` = 1000

8.17.1 Detailed Description

This file contains the `ImGuiWindowManager` class.

Definition in file [Gui.hpp](#).

8.18 Gui.hpp

[Go to the documentation of this file.](#)

```
00001 ///
00002 /// @file Gui.hpp
00003 /// @brief This file contains the ImGuiWindowManager class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <imgui.h>
00010
00011 #include "VEngine/Core/FrameInfo.hpp"
00012 #include "VEngine/Scene/Manager.hpp"
00013 #include "VEngine/Gfx/Renderer.hpp"
00014
00015 namespace ven {
00016
00017     static constexpr uint16_t DESCRIPTOR_COUNT = 1000;
00018
00019     enum GUI_STATE : uint8_t {
00020         SHOW_EDITOR = 0,
00021         SHOW_PLAYER = 1,
00022         HIDDEN = 2
00023     };
00024
00025     ///
00026     /// @class Gui
00027     /// @brief Class for Gui
00028     /// @namespace ven
00029     ///
00030     class Gui {
00031
00032     public:
00033         struct ClockData {
00034             float deltaTimeMS{0.0F};
00035             float fps{0.0F};
00036         };
00037
00038         Gui() = default;
00039         ~Gui() = default;
00040
00041         Gui(const Gui&) = delete;
00042         Gui& operator=(const Gui&) = delete;
00043
00044         void init(GLFWwindow* window, VkInstance instance, const Device* device, VkRenderPass
00045 renderPass);
00046
00047         void render(Renderer* renderer, SceneManager& sceneManager, Camera& camera,
00048 VkPhysicalDevice physicalDevice, GlobalUbo& ubo, const ClockData& clockData);
00049         static void cleanup();
00050
00051         void setState(const GUI_STATE state) { m_state = state; }
00052         [[nodiscard]] GUI_STATE getState() const { return m_state; }
```

```

00052         [[nodiscard]] std::vector<unsigned int> *getObjectsToRemove() { return &m_objectsToRemove;
    }
00053         [[nodiscard]] std::vector<unsigned int> *getLightsToRemove() { return &m_lightsToRemove; }
00054
00055     private:
00056
00057         static void initStyle();
00058         static void renderFrameWindow(const ClockData& clockData);
00059         static void cameraSection(Camera& camera);
00060         static void inputsSection(const ImGuiIO& io);
00061         static void rendererSection(Renderer *renderer, GlobalUbo& ubo);
00062         static void devicePropertiesSection(VkPhysicalDeviceProperties deviceProperties);
00063         void objectsSection(SceneManager& sceneManager);
00064         void lightsSection(SceneManager& sceneManager);
00065
00066         struct funcs { static bool IsLegacyNativeDupe(const ImGuiKey key) { return key >= 0 && key
    < 512 && ImGui::GetIO().KeyMap[key] != -1; } }; // Hide Native<>ImGuiKey duplicates when both exist
00067
00068         ImGuiIO* m_io{nullptr};
00069         GUI_STATE m_state{HIDDEN};
00070         float m_intensity{1.0F};
00071         float m_shininess{DEFAULT_SHININESS};
00072
00073         std::vector<unsigned int> m_objectsToRemove;
00074         std::vector<unsigned int> m_lightsToRemove;
00075
00076     }; // class Gui
00077
00078 } // namespace ven

```

8.19 /home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/ABase.hpp File Reference

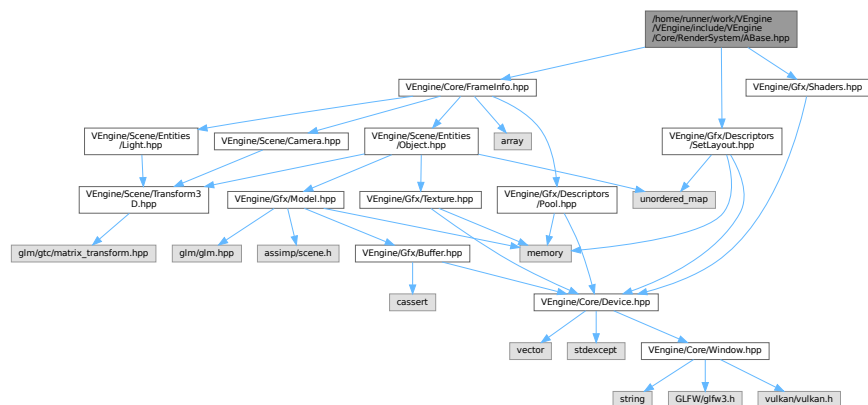
This file contains the ARenderSystemBase class.

```

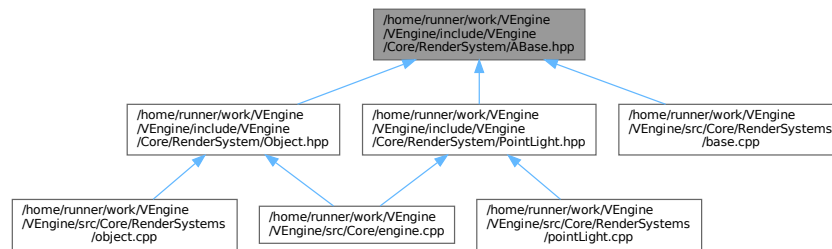
#include "VEngine/Core/FrameInfo.hpp"
#include "VEngine/Gfx/Descriptors/SetLayout.hpp"
#include "VEngine/Gfx/Shaders.hpp"

```

Include dependency graph for ABase.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class [ven::ARenderSystemBase](#)
Abstract class for render system base.

Namespaces

- namespace [ven](#)

8.19.1 Detailed Description

This file contains the ARenderSystemBase class.

Definition in file [ABase.hpp](#).

8.20 ABase.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file ABase.hpp
00003 /// @brief This file contains the ARenderSystemBase class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include "VEngine/Core/FrameInfo.hpp"
00010 #include "VEngine/Gfx/Descriptors/SetLayout.hpp"
00011 #include "VEngine/Gfx/Shaders.hpp"
00012
00013 namespace ven {
00014
00015     ///
00016     /// @class ARenderSystemBase
00017     /// @brief Abstract class for render system base
00018     /// @namespace ven
00019     ///
00020     class ARenderSystemBase {
00021     public:
00022
00023         explicit ARenderSystemBase(Device& device) : m_device{device} {}
00024         virtual ~ARenderSystemBase() { vkDestroyPipelineLayout(m_device.device(),
00025             m_pipelineLayout, nullptr); }
00026
00027         virtual void render(const FrameInfo &frameInfo) const = 0;
  
```

```

00028
00029     protected:
00030
00031         void createPipelineLayout(VkDescriptorSetLayout globalSetLayout, uint32_t
pushConstantSize);
00032         void createPipeline(VkRenderPass renderPass, const std::string &shadersVertPath, const
std::string &shadersFragPath, bool isLight);
00033
00034         [[nodiscard]] Device& getDevice() const { return m_device; }
00035         [[nodiscard]] VkPipelineLayout getPipelineLayout() const { return m_pipelineLayout; }
00036         [[nodiscard]] const std::unique_ptr<Shaders>& getShaders() const { return m_shaders; }
00037
00038         std::unique_ptr<DescriptorSetLayout> renderSystemLayout;
00039
00040     private:
00041
00042         Device &m_device;
00043         VkPipelineLayout m_pipelineLayout{nullptr};
00044         std::unique_ptr<Shaders> m_shaders;
00045
00046
00047     }; // class ARenderSystemBase
00048
00049 } // namespace ven

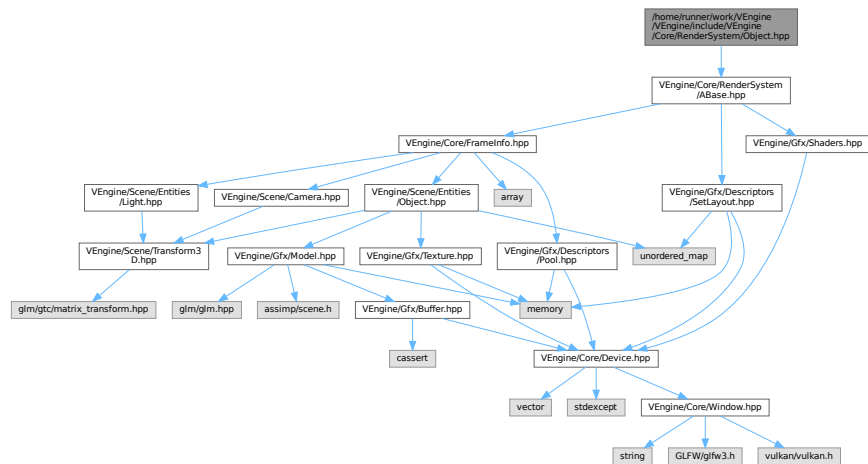
```

8.21 /home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/Object.hpp File Reference

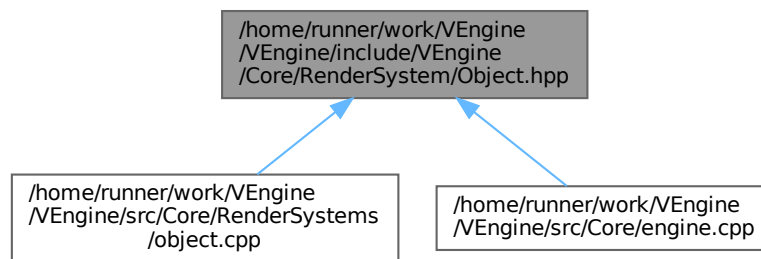
This file contains the ObjectRenderSystem class.

```
#include "VEngine/Core/RenderSystem/ABase.hpp"
```

Include dependency graph for Object.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct [ven::ObjectPushConstantData](#)
- class [ven::ObjectRenderSystem](#)
Class for object render system.

Namespaces

- namespace [ven](#)

8.21.1 Detailed Description

This file contains the ObjectRenderSystem class.

Definition in file [Object.hpp](#).

8.22 Object.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file Object.hpp
00003 /// @brief This file contains the ObjectRenderSystem class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include "VEngine/Core/RenderSystem/ABase.hpp"
00010
00011 namespace ven {
00012
00013     struct ObjectPushConstantData {
00014         glm::mat4 modelMatrix{};
00015         glm::mat4 normalMatrix{};
00016     };
00017
00018     ///
00019     /// @class ObjectRenderSystem
00020     /// @brief Class for object render system
00021     /// @namespace ven
00022     ///
  
```

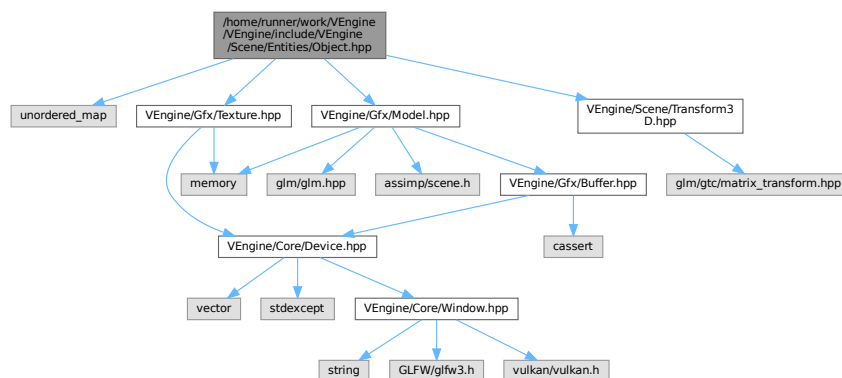


```
00023     class ObjectRenderSystem final : public ARenderSystemBase {
00024
00025         public:
00026
00027             explicit ObjectRenderSystem(Device& device, const VkRenderPass renderPass, const
VkDescriptorSetLayout globalSetLayout) : ARenderSystemBase(device) {
00028                 createPipelineLayout(globalSetLayout, sizeof(ObjectPushConstantData));
00029                 createPipeline(renderPass, std::string(SHADERS_BIN_PATH) + "vertex_shader.spv",
std::string(SHADERS_BIN_PATH) + "fragment_shader.spv", false);
00030             }
00031
00032             ObjectRenderSystem(const ObjectRenderSystem&) = delete;
00033             ObjectRenderSystem& operator=(const ObjectRenderSystem&) = delete;
00034
00035             void render(const FrameInfo &frameInfo) const override;
00036
00037         }; // class ObjectRenderSystem
00038
00039 } // namespace ven
```

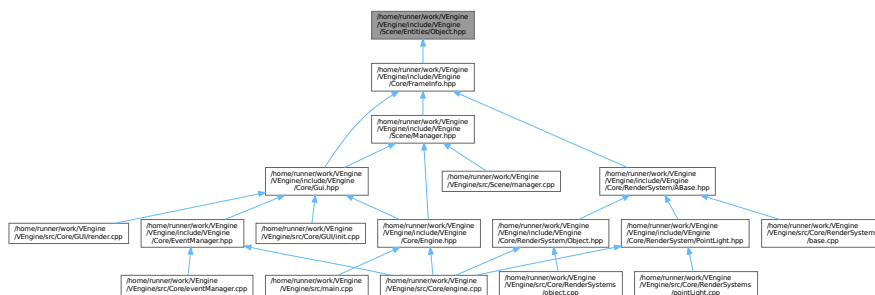
8.23 /home/runner/work/VEngine/VEngine/include/VEngine/Scene/Entities/Object.hpp File Reference

This file contains the Object class.

```
#include <unordered_map>
#include "VEngine/Gfx/Texture.hpp"
#include "VEngine/Gfx/Model.hpp"
#include "VEngine/Scene/Transform3D.hpp"
Include dependency graph for Object.hpp:
```



This graph shows which files directly or indirectly include this file:



Classes

- class [ven::Object](#)
Class for object.

Namespaces

- namespace [ven](#)

Variables

- static constexpr uint16_t [ven::MAX_OBJECTS](#) = 1000

8.23.1 Detailed Description

This file contains the Object class.

Definition in file [Object.hpp](#).

8.24 Object.hpp

[Go to the documentation of this file.](#)

```
00001 ///  
00002 ///  
00003 ///  
00004 ///  
00005 ///  
00006 ///  
00007 #pragma once  
00008 ///  
00009 #include <unordered_map>  
00010 ///  
00011 #include "VEngine/Gfx/Texture.hpp"  
00012 #include "VEngine/Gfx/Model.hpp"  
00013 #include "VEngine/Scene/Transform3D.hpp"  
00014 ///  
00015 namespace ven {  
00016     static constexpr uint16_t MAX_OBJECTS = 1000;  
00017     ///  
00018     ///  
00019     ///  
00020     ///  
00021     ///  
00022     ///  
00023     ///  
00024     class Object {  
00025     public:  
00026     public:  
00027         using Map = std::unordered_map<unsigned int, Object>;  
00028         explicit Object(const unsigned int objId) : m_objId{objId} {}  
00029         ~Object() = default;  
00030         Object(const Object &) = delete;  
00031         Object &operator=(const Object &) = delete;  
00032         Object(Object &&) = default;  
00033         Object &operator=(Object &&) = default;  
00034         [[nodiscard]] unsigned int getId() const { return m_objId; }  
00035         [[nodiscard]] std::string getName() const { return m_name; }  
00036         [[nodiscard]] std::shared_ptr<Model> getModel() const { return m_model; }  
00037         [[nodiscard]] std::shared_ptr<Texture> getDiffuseMap() const { return m_diffuseMap; }  
00038         [[nodiscard]] VkDescriptorBufferInfo getBufferInfo(const int frameIndex) const { return  
00039         m_bufferInfo.at(frameIndex); }
```

```

00044         void setModel(const std::shared_ptr<Model> &model) { m_model = model; }
00045         void setDiffuseMap(const std::shared_ptr<Texture> &diffuseMap) { m_diffuseMap =
diffuseMap; }
00046         void setName(const std::string &name) { m_name = name; }
00047         void setBufferInfo(const int frameIndex, const VkDescriptorBufferInfo& info) {
00048             m_bufferInfo[frameIndex] = info;
00049         }
00050
00051         Transform3D transform{};
00052
00053     private:
00054
00055         unsigned int m_objId;
00056         std::string m_name;
00057         std::shared_ptr<Model> m_model = nullptr;
00058         std::shared_ptr<Texture> m_diffuseMap = nullptr;
00059         std::unordered_map<int, VkDescriptorBufferInfo> m_bufferInfo;
00060
00061     }; // class Object
00062
00063 } // namespace ven

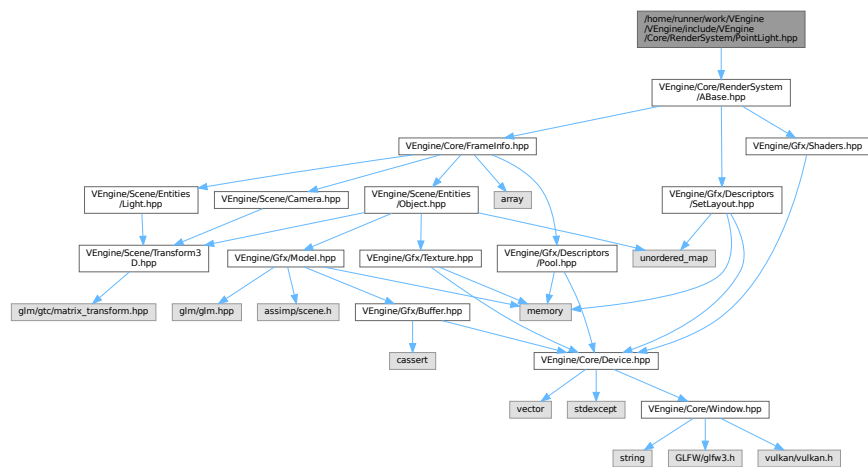
```

8.25 /home/runner/work/VEngine/VEngine/include/VEngine/Core/RenderSystem/PointLight.hpp File Reference

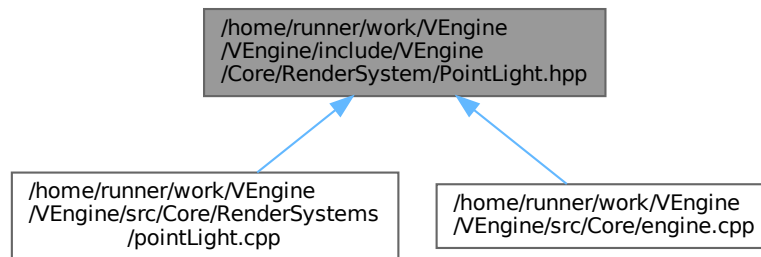
This file contains the PointLightRenderSystem class.

```
#include "VEngine/Core/RenderSystem/ABase.hpp"
```

Include dependency graph for PointLight.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct [ven::LightPushConstantData](#)
- class [ven::PointLightRenderSystem](#)

Class for point light system.

Namespaces

- namespace [ven](#)

8.25.1 Detailed Description

This file contains the PointLightRenderSystem class.

Definition in file [PointLight.hpp](#).

8.26 PointLight.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file PointLight.hpp
00003 /// @brief This file contains the PointLightRenderSystem class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include "VEngine/Core/RenderSystem/ABase.hpp"
00010
00011 namespace ven {
00012
00013     struct LightPushConstantData {
00014         glm::vec4 position{};
00015         glm::vec4 color{};
00016         float radius;
00017     };
00018
00019     ///
00020     /// @class PointLightRenderSystem
00021     /// @brief Class for point light system
00022     /// @namespace ven
  
```

```

00023     ///
00024     class PointLightRenderSystem final : public ARenderSystemBase {
00025     public:
00026         explicit PointLightRenderSystem(Device& device, const VkRenderPass renderPass, const
00027         VkDescriptorSetLayout globalSetLayout) : ARenderSystemBase(device) {
00028             createPipelineLayout(globalSetLayout, sizeof(LightPushConstantData));
00029             createPipeline(renderPass, std::string(SHADERS_BIN_PATH) + "vertex_point_light.spv",
00030             std::string(SHADERS_BIN_PATH) + "fragment_point_light.spv", true);
00031         }
00032         PointLightRenderSystem(const PointLightRenderSystem&) = delete;
00033         PointLightRenderSystem& operator=(const PointLightRenderSystem&) = delete;
00034         void render(const FrameInfo &frameInfo) const override;
00035     }; // class PointLightRenderSystem
00036 } // namespace ven

```

8.27 /home/runner/work/VEngine/VEngine/include/VEngine/Core/Window.hpp File Reference

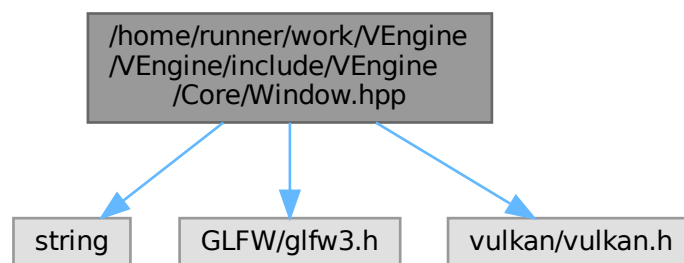
This file contains the Window class.

```

#include <string>
#include <GLFW/glfw3.h>
#include <vulkan/vulkan.h>

```

Include dependency graph for Window.hpp:



8.28 Window.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file Window.hpp
00003 /// @brief This file contains the Window class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <string>
00010
00011 #define GLFW_INCLUDE_VULKAN
00012 #include <GLFW/glfw3.h>
00013 #include <vulkan/vulkan.h>
00014
00015 namespace ven {
00016
00017     static constexpr uint32_t DEFAULT_WIDTH = 1920;
00018     static constexpr uint32_t DEFAULT_HEIGHT = 1080;
00019     static constexpr std::string_view DEFAULT_TITLE = "VEngine";
00020
00021     ///
00022     /// @class Window
00023     /// @brief Class for window
00024     /// @namespace ven
00025     ///
00026     class Window {
00027
00028     public:
00029
00030         explicit Window(const uint32_t width = DEFAULT_WIDTH, const uint32_t height =
DEFAULT_HEIGHT, const std::string &title = DEFAULT_TITLE.data()) : m_window(createWindow(width,
height, title)), m_width(width), m_height(height) {}
00031         ~Window() { glfwDestroyWindow(m_window); glfwTerminate(); m_window = nullptr; }
00032
00033         Window(const Window&) = delete;
00034         Window& operator=(const Window&) = delete;
00035
00036         [[nodiscard]] GLFWwindow* createWindow(uint32_t width, uint32_t height, const std::string
&title);
00037         void createWindowSurface(VkInstance instance, VkSurfaceKHR* surface) const;
00038
00039         [[nodiscard]] GLFWwindow* getGLFWWindow() const { return m_window; }
00040
00041         [[nodiscard]] VkExtent2D getExtent() const { return {m_width, m_height}; }
00042         [[nodiscard]] bool wasWindowResized() const { return m_framebufferResized; }
00043         void resetWindowResizedFlag() { m_framebufferResized = false; }
00044
00045         void setFullscreen(bool fullscreen, uint32_t width, uint32_t height);
00046
00047     private:
00048
00049         static void framebufferResizeCallback(GLFWwindow* window, int width, int height);
00050
00051         GLFWwindow* m_window{nullptr};
00052         uint32_t m_width{DEFAULT_WIDTH};
00053         uint32_t m_height{DEFAULT_HEIGHT};
00054
00055         bool m_framebufferResized = false;
00056
00057     }; // class Window
00058
00059 } // namespace ven

```

8.29 /home/runner/work/VEngine/VEngine/include/VEngine/Gfx/↵ Buffer.hpp File Reference

This file contains the Buffer class.

```

#include <cassert>
#include "VEngine/Core/Device.hpp"

```


8.30 Buffer.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file Buffer.hpp
00003 /// @brief This file contains the Buffer class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <cassert>
00010
00011 #include "VEngine/Core/Device.hpp"
00012
00013 namespace ven {
00014
00015     ///
00016     /// @class Buffer
00017     /// @brief Class for buffer
00018     /// @namespace ven
00019     ///
00020     class Buffer {
00021
00022     public:
00023
00024         Buffer(Device& device, VkDeviceSize instanceSize, uint32_t instanceCount,
VkBufferUsageFlags usageFlags, VkMemoryPropertyFlags memoryPropertyFlags, VkDeviceSize
minOffsetAlignment = 1);
00025         ~Buffer();
00026
00027         Buffer(const Buffer&) = delete;
00028         Buffer& operator=(const Buffer&) = delete;
00029
00030         ///
00031         /// @brief Map a memory range of this buffer. If successful, mapped points to the
specified buffer range.
00032         ///
00033         /// @param size (Optional) Size of the memory range to map. Pass VK_WHOLE_SIZE to map the
complete buffer range.
00034         /// @param offset (Optional) Byte offset from beginning
00035         ///
00036         /// @return VkResult of the buffer mapping call
00037         ///
00038         VkResult map(VkDeviceSize size = VK_WHOLE_SIZE, VkDeviceSize offset = 0);
00039
00040         ///
00041         /// @brief Unmap a mapped memory range
00042         ///
00043         /// @note Does not return a result as vkUnmapMemory can't fail
00044         ///
00045         void unmap();
00046
00047         ///
00048         /// @brief Copies the specified data to the mapped buffer. Default value writes whole
buffer range
00049         ///
00050         /// @param data Pointer to the data to copy
00051         /// @param size (Optional) Size of the data to copy. Pass VK_WHOLE_SIZE to flush the
complete buffer range.
00052         /// @param offset (Optional) Byte offset from beginning of mapped region
00053         ///
00054         void writeToBuffer(const void* data, VkDeviceSize size = VK_WHOLE_SIZE, VkDeviceSize
offset = 0) const;
00055
00056         ///
00057         /// @brief Flush a memory range of the buffer to make it visible to the device
00058         ///
00059         /// @note Only required for non-coherent memory
00060         ///
00061         /// @param size (Optional) Size of the memory range to flush. Pass VK_WHOLE_SIZE to flush
the complete buffer range.
00062         /// @param offset (Optional) Byte offset from beginning
00063         ///
00064         /// @return VkResult of the flush call
00065         ///
00066         VkResult flush(VkDeviceSize size = VK_WHOLE_SIZE, VkDeviceSize offset = 0) const;
00067
00068         ///
00069         /// @brief Create a buffer info descriptor
00070         ///
00071         /// @param size (Optional) Size of the memory range of the descriptor
00072         /// @param offset (Optional) Byte offset from beginning
00073         ///
00074         /// @return VkDescriptorBufferInfo of specified offset and range

```

```

00075         ///
00076         [[nodiscard]] VkDescriptorBufferInfo descriptorInfo(const VkDeviceSize size =
VK_WHOLE_SIZE, const VkDeviceSize offset = 0) const { return VkDescriptorBufferInfo{m_buffer, offset,
size, }; }
00077
00078         ///
00079         /// @brief Invalidate a memory range of the buffer to make it visible to the host
00080         ///
00081         /// @note Only required for non-coherent memory
00082         ///
00083         /// @param size (Optional) Size of the memory range to invalidate. Pass VK_WHOLE_SIZE to
invalidate
00084         /// the complete buffer range.
00085         /// @param offset (Optional) Byte offset from beginning
00086         ///
00087         /// @return VkResult of the invalidate call
00088         ///
00089         [[nodiscard]] VkResult invalidate(VkDeviceSize size = VK_WHOLE_SIZE, VkDeviceSize offset =
0) const;
00090
00091         ///
00092         /// Copies "instanceSize" bytes of data to the mapped buffer at an offset of index *
alignmentSize
00093         ///
00094         /// @param data Pointer to the data to copy
00095         /// @param index Used in offset calculation
00096         ///
00097         void writeToIndex(const void* data, const VkDeviceSize index) const { writeToBuffer(data,
m_instanceSize, index * m_alignmentSize); }
00098
00099         ///
00100         /// Flush the memory range at index * alignmentSize of the buffer to make it visible to
the device
00101         ///
00102         /// @param index Used in offset calculation
00103         ///
00104         VkResult flushIndex(const VkDeviceSize index) const { assert(m_alignmentSize %
m_device.getProperties().limits.nonCoherentAtomSize == 0 && "Cannot use LveBuffer::flushIndex if
alignmentSize isn't a multiple of Device Limits nonCoherentAtomSize"); return flush(m_alignmentSize,
index * m_alignmentSize); }
00105
00106         ///
00107         ///
00108         /// Create a buffer info descriptor
00109         ///
00110         /// @param index Specifies the region given by index * alignmentSize
00111         ///
00112         /// @return VkDescriptorBufferInfo for instance at index
00113         ///
00114         [[nodiscard]] VkDescriptorBufferInfo descriptorInfoForIndex(const VkDeviceSize index)
const { return descriptorInfo(m_alignmentSize, index * m_alignmentSize); }
00115
00116         ///
00117         /// Invalidate a memory range of the buffer to make it visible to the host
00118         ///
00119         /// @note Only required for non-coherent memory
00120         ///
00121         /// @param index Specifies the region to invalidate: index * alignmentSize
00122         ///
00123         /// @return VkResult of the invalidate call
00124         ///
00125         [[nodiscard]] VkResult invalidateIndex(const VkDeviceSize index) const { return
invalidate(m_alignmentSize, index * m_alignmentSize); }
00126
00127         [[nodiscard]] VkBuffer getBuffer() const { return m_buffer; }
00128         [[nodiscard]] void* getMappedMemory() const { return m_mapped; }
00129         [[nodiscard]] uint32_t getInstanceCount() const { return m_instanceCount; }
00130         [[nodiscard]] VkDeviceSize getInstanceSize() const { return m_instanceSize; }
00131         [[nodiscard]] VkDeviceSize getAlignmentSize() const { return m_alignmentSize; }
00132         [[nodiscard]] VkBufferUsageFlags getUsageFlags() const { return m_usageFlags; }
00133         [[nodiscard]] VkMemoryPropertyFlags getMemoryPropertyFlags() const { return
m_memoryPropertyFlags; }
00134         [[nodiscard]] VkDeviceSize getBufferSize() const { return m_bufferSize; }
00135
00136     private:
00137         ///
00138         /// Returns the minimum instance size required to be compatible with devices
minOffsetAlignment
00139         ///
00140         /// @param instanceSize The size of an instance
00141         /// @param minOffsetAlignment The minimum required alignment, in bytes, for the offset
member (eg
00142         /// minUniformBufferOffsetAlignment)
00143         ///
00144         /// @return VkResult of the buffer mapping call
00145         ///
00146

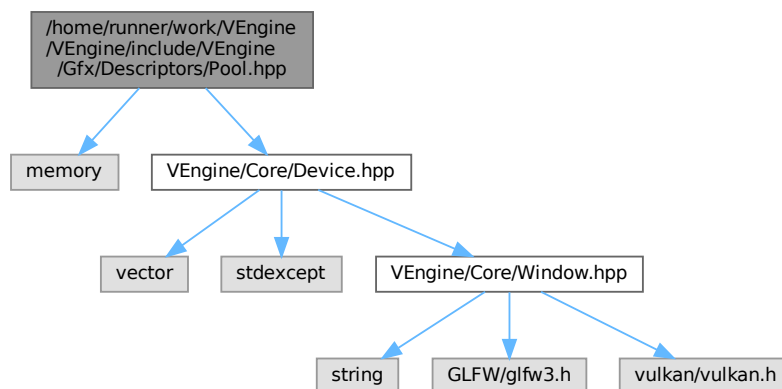
```

```
00147         static VkDeviceSize getAlignment(const VkDeviceSize instanceSize, const VkDeviceSize
minOffsetAlignment) { return (minOffsetAlignment > 0) ? (instanceSize + minOffsetAlignment - 1) &
~(minOffsetAlignment - 1) : instanceSize; }
00148
00149         Device& m_device;
00150         void* m_mapped = nullptr;
00151         VkBuffer m_buffer = VK_NULL_HANDLE;
00152         VkDeviceMemory m_memory = VK_NULL_HANDLE;
00153
00154         VkDeviceSize m_bufferSize;
00155         VkDeviceSize m_instanceSize;
00156         uint32_t m_instanceCount;
00157         VkDeviceSize m_alignmentSize;
00158         VkBufferUsageFlags m_usageFlags;
00159         VkMemoryPropertyFlags m_memoryPropertyFlags;
00160
00161     }; // class Buffer
00162
00163 } // namespace ven
```

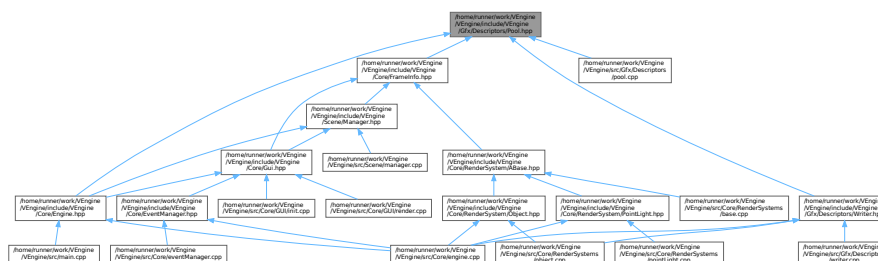
8.31 /home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/Pool.hpp File Reference

This file contains the DescriptorPool class.

```
#include <memory>
#include "VEngine/Core/Device.hpp"
Include dependency graph for Pool.hpp:
```



This graph shows which files directly or indirectly include this file:



Classes

- class [ven::DescriptorPool](#)
Class for descriptor pool.
- class [ven::DescriptorPool::Builder](#)

Namespaces

- namespace [ven](#)

Variables

- static constexpr uint32_t [ven::DEFAULT_MAX_SETS](#) = 1000

8.31.1 Detailed Description

This file contains the DescriptorPool class.

Definition in file [Pool.hpp](#).

8.32 Pool.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file Pool.hpp
00003 /// @brief This file contains the DescriptorPool class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <memory>
00010
00011 #include "VEngine/Core/Device.hpp"
00012
00013 namespace ven {
00014
00015     static constexpr uint32_t DEFAULT_MAX_SETS = 1000;
00016
00017     ///
00018     /// @class DescriptorPool
00019     /// @brief Class for descriptor pool
00020     /// @namespace ven
00021     ///
00022     class DescriptorPool {
00023     public:
00024
00025         class Builder {
00026         public:
00027
00028             explicit Builder(Device &device) : m_device{device} {}
00029
00030             [[nodiscard]] std::unique_ptr<DescriptorPool> build() const { return
00031 std::make_unique<DescriptorPool>(m_device, m_maxSets, m_poolFlags, m_poolSizes); }
00032
00033             Builder &addPoolSize(const VkDescriptorType descriptorType, const uint32_t count)
00034 { m_poolSizes.push_back({descriptorType, count}); return *this; }
00035             Builder &setPoolFlags(const VkDescriptorPoolCreateFlags flags) { m_poolFlags =
00036 flags; return *this; }
00037             Builder &setMaxSets(const uint32_t count) { m_maxSets = count; return *this; }
00038
00039         private:

```

```

00040         Device &m_device;
00041         std::vector<VkDescriptorPoolSize> m_poolSizes;
00042         uint32_t m_maxSets{DEFAULT_MAX_SETS};
00043         VkDescriptorPoolCreateFlags m_poolFlags{0};
00044
00045     }; // class Builder
00046
00047     DescriptorPool(Device &device, uint32_t maxSets, VkDescriptorPoolCreateFlags poolFlags,
00048         const std::vector<VkDescriptorPoolSize> &poolSizes);
00049     ~DescriptorPool() { vkDestroyDescriptorPool(m_device.device(), m_descriptorPool, nullptr); }
00050
00051     DescriptorPool(const DescriptorPool &) = delete;
00052     DescriptorPool &operator=(const DescriptorPool &) = delete;
00053
00054     bool allocateDescriptor(VkDescriptorSetLayout descriptorSetLayout, VkDescriptorSet
00055         &descriptor) const;
00056     void freeDescriptors(const std::vector<VkDescriptorSet> &descriptors) const {
00057         vkFreeDescriptorSets(m_device.device(), m_descriptorPool, static_cast<uint32_t>(descriptors.size()),
00058             descriptors.data()); }
00059     void resetPool() const { vkResetDescriptorPool(m_device.device(), m_descriptorPool, 0); }
00060
00061     [[nodiscard]] VkDescriptorPool getDescriptorPool() const { return m_descriptorPool; }
00062
00063 private:
00064     Device &m_device;
00065     VkDescriptorPool m_descriptorPool;
00066     friend class DescriptorWriter;
00067 }; // class DescriptorPool
00068 } // namespace ven

```

8.33 /home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/SetLayout.hpp File Reference

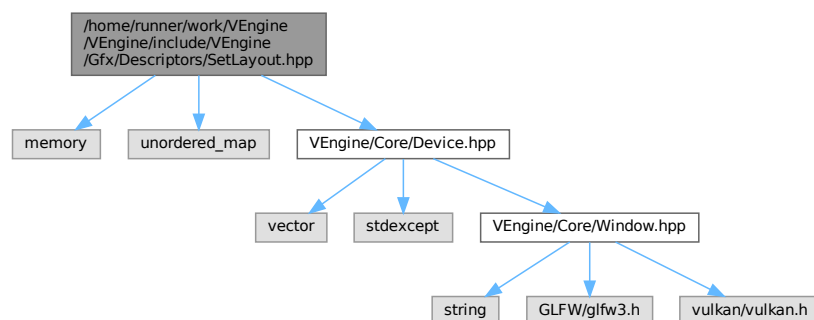
This file contains the DescriptorSetLayout class.

```

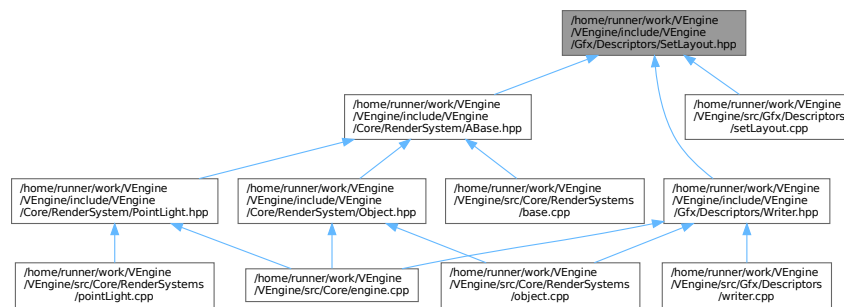
#include <memory>
#include <unordered_map>
#include "VEngine/Core/Device.hpp"

```

Include dependency graph for SetLayout.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class [ven::DescriptorSetLayout](#)
Class for descriptor set layout.
- class [ven::DescriptorSetLayout::Builder](#)

Namespaces

- namespace [ven](#)

8.33.1 Detailed Description

This file contains the DescriptorSetLayout class.

Definition in file [SetLayout.hpp](#).

8.34 SetLayout.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file SetLayout.hpp
00003 /// @brief This file contains the DescriptorSetLayout class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <memory>
00010 #include <unordered_map>
00011
00012 #include "VEngine/Core/Device.hpp"
00013
00014 namespace ven {
00015
00016     ///
00017     /// @class DescriptorSetLayout
00018     /// @brief Class for descriptor set layout
00019     /// @namespace ven
00020     ///
00021     class DescriptorSetLayout {
00022     public:
00023
00024 
```

```

00025         class Builder {
00026
00027             public:
00028
00029                 explicit Builder(Device &device) : m_device{device} {}
00030
00031                 Builder &addBinding(uint32_t binding, VkDescriptorType descriptorType,
00032                                     VkShaderStageFlags stageFlags, uint32_t count = 1);
00033                 std::unique_ptr<DescriptorSetLayout> build() const { return
00034                 std::make_unique<DescriptorSetLayout>(m_device, m_bindings); }
00035
00036             private:
00037                 Device &m_device;
00038                 std::unordered_map<uint32_t, VkDescriptorSetLayoutBinding> m_bindings;
00039
00040         }; // class Builder
00041
00042         DescriptorSetLayout(Device &device, const std::unordered_map<uint32_t,
00043                             VkDescriptorSetLayoutBinding>& bindings);
00044         ~DescriptorSetLayout() { vkDestroyDescriptorSetLayout(m_device.device(),
00045                             m_descriptorSetLayout, nullptr); }
00046
00047         DescriptorSetLayout(const DescriptorSetLayout &) = delete;
00048         DescriptorSetLayout &operator=(const DescriptorSetLayout &) = delete;
00049
00050         VkDescriptorSetLayout getDescriptorSetLayout() const { return m_descriptorSetLayout; }
00051
00052     private:
00053         Device &m_device;
00054         VkDescriptorSetLayout m_descriptorSetLayout;
00055         std::unordered_map<uint32_t, VkDescriptorSetLayoutBinding> m_bindings;
00056
00057         friend class DescriptorWriter;
00058
00059 }; // class DescriptorSetLayout
00060 } // namespace ven

```

8.35 /home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Descriptors/Writer.hpp File Reference

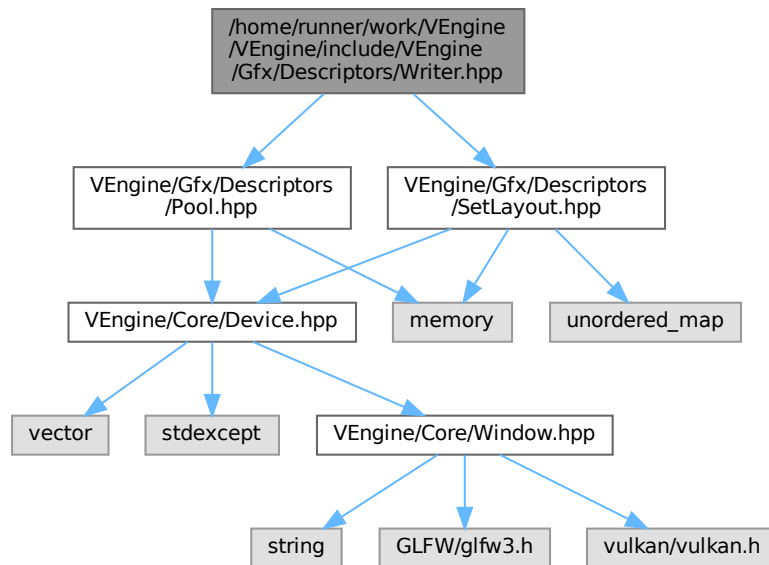
This file contains the DescriptorsWriter class.

```

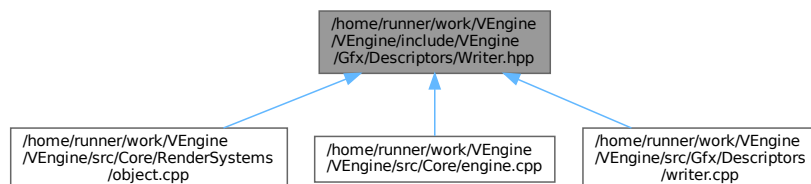
#include "VEngine/Gfx/Descriptors/Pool.hpp"
#include "VEngine/Gfx/Descriptors/SetLayout.hpp"

```

Include dependency graph for Writer.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class `ven::DescriptorWriter`
Class for descriptor writer.

Namespaces

- namespace `ven`

8.35.1 Detailed Description

This file contains the `DescriptorsWriter` class.

Definition in file `Writer.hpp`.

8.36 Writer.hpp

[Go to the documentation of this file.](#)

```

00001 ///  

00002 ///  

00003 ///  

00004 ///  

00005 ///  

00006 ///  

00007 #pragma once  

00008 ///  

00009 #include "VEngine/Gfx/Descriptors/Pool.hpp"  

00010 #include "VEngine/Gfx/Descriptors/SetLayout.hpp"  

00011 ///  

00012 namespace ven {  

00013     ///  

00014     ///  

00015     ///  

00016     ///  

00017     ///  

00018     ///  

00019     class DescriptorWriter {  

00020     public:  

00021         DescriptorWriter(DescriptorSetLayout &setLayout, DescriptorPool &pool) :  

00022             m_setLayout{setLayout}, m_pool{pool} {}  

00023         ~DescriptorWriter() = default;  

00024         DescriptorWriter(const DescriptorWriter &) = delete;  

00025         DescriptorWriter &operator=(const DescriptorWriter &) = delete;  

00026         DescriptorWriter &writeBuffer(uint32_t binding, const VkDescriptorBufferInfo *bufferInfo);  

00027         DescriptorWriter &writeImage(uint32_t binding, const VkDescriptorImageInfo *imageInfo);  

00028         bool build(VkDescriptorSet &set);  

00029         void overwrite(const VkDescriptorSet &set);  

00030     private:  

00031         DescriptorSetLayout &m_setLayout;  

00032         DescriptorPool &m_pool;  

00033         std::vector<VkWriteDescriptorSet> m_writes;  

00034     }; // class DescriptorWriter  

00035 } // namespace ven

```

8.37 /home/runner/work/VEngine/VEngine/include/VEngine/Gfx/↵ Model.hpp File Reference

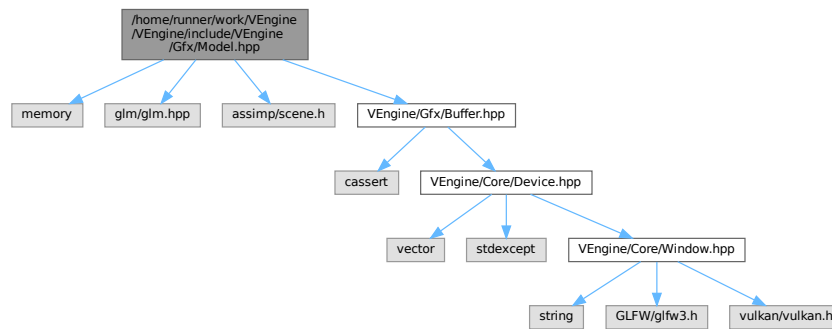
This file contains the Model class.

```

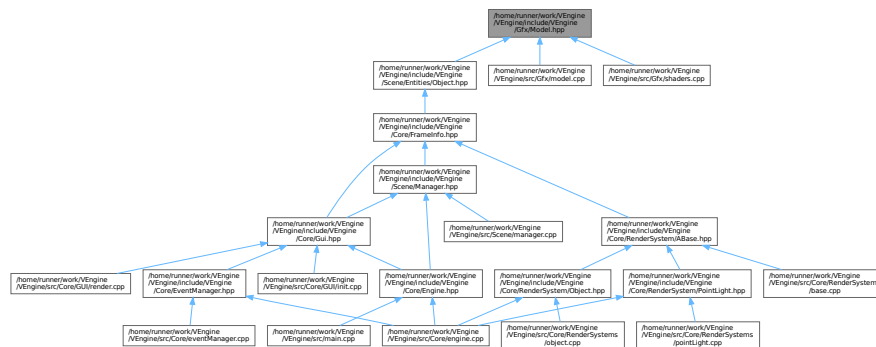
#include <memory>
#include <glm/glm.hpp>
#include <assimp/scene.h>
#include "VEngine/Gfx/Buffer.hpp"

```

Include dependency graph for Model.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class [ven::Model](#)
Class for model.
- struct [ven::Model::Vertex](#)
- struct [ven::Model::Builder](#)

Namespaces

- namespace [ven](#)

8.37.1 Detailed Description

This file contains the Model class.

Definition in file [Model.hpp](#).

8.38 Model.hpp

[Go to the documentation of this file.](#)

```

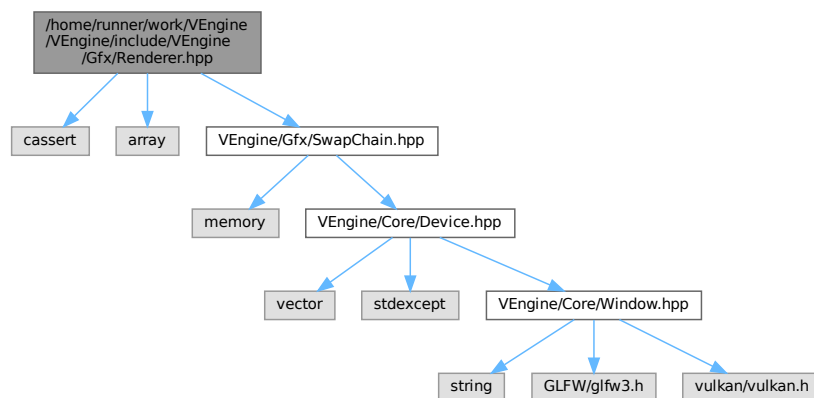
00001 ///
00002 /// @file Model.hpp
00003 /// @brief This file contains the Model class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <memory>
00010
00011 #include <glm/glm.hpp>
00012
00013 #include <assimp/scene.h>
00014
00015 #include "VEngine/Gfx/Buffer.hpp"
00016
00017 namespace ven {
00018
00019     ///
00020     /// @class Model
00021     /// @brief Class for model
00022     /// @namespace ven
00023     ///
00024     class Model {
00025
00026     public:
00027
00028         struct Vertex {
00029             glm::vec3 position{};
00030             glm::vec3 color{};
00031             glm::vec3 normal{};
00032             glm::vec2 uv{};
00033
00034             static std::vector<VkVertexInputBindingDescription> getBindingDescriptions();
00035             static std::vector<VkVertexInputAttributeDescription> getAttributeDescriptions();
00036
00037             bool operator==(const Vertex& other) const {
00038                 return position == other.position && color == other.color && normal ==
other.normal && uv == other.uv;
00039             }
00040         };
00041
00042         struct Builder {
00043             std::vector<Vertex> vertices;
00044             std::vector<uint32_t> indices;
00045
00046             void loadModel(const std::string &filename);
00047             void processNode(const aiNode* node, const aiScene* scene);
00048             void processMesh(const aiMesh* mesh, const aiScene* scene);
00049         };
00050
00051         Model(Device &device, const Builder &builder);
00052         ~Model() = default;
00053
00054         Model(const Model&) = delete;
00055         void operator=(const Model&) = delete;
00056
00057         static std::unique_ptr<Model> createModelFromFile(Device &device, const std::string
&filename);
00058
00059         void bind(VkCommandBuffer commandBuffer) const;
00060         void draw(VkCommandBuffer commandBuffer) const;
00061
00062     private:
00063
00064         void createVertexBuffer(const std::vector<Vertex>& vertices);
00065         void createIndexBuffer(const std::vector<uint32_t>& indices);
00066
00067         Device& m_device;
00068         std::unique_ptr<Buffer> m_vertexBuffer;
00069         uint32_t m_vertexCount;
00070
00071         bool m_hasIndexBuffer{false};
00072         std::unique_ptr<Buffer> m_indexBuffer;
00073         uint32_t m_indexCount;
00074
00075     }; // class Model
00076
00077 } // namespace ven

```

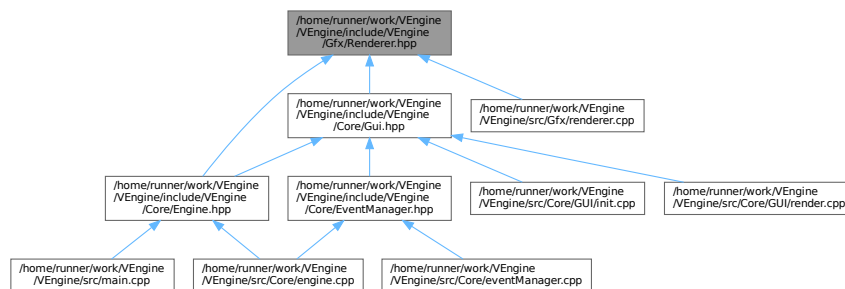
8.39 /home/runner/work/VEngine/VEngine/include/VEngine/Gfx/↵ Renderer.hpp File Reference

This file contains the `Renderer` class.

```
#include <cassert>
#include <array>
#include "VEngine/Gfx/SwapChain.hpp"
Include dependency graph for Renderer.hpp:
```



This graph shows which files directly or indirectly include this file:



Classes

- class `ven::Renderer`
Class for renderer.

Namespaces

- namespace `ven`

Variables

- static constexpr VkClearColorValue `ven::DEFAULT_CLEAR_COLOR` = {{0.0F, 0.0F, 0.0F, 1.0F}}
- static constexpr VkClearDepthStencilValue `ven::DEFAULT_CLEAR_DEPTH` = {1.0F, 0}

8.39.1 Detailed Description

This file contains the Renderer class.

Definition in file [Renderer.hpp](#).

8.40 Renderer.hpp

[Go to the documentation of this file.](#)

```
00001 ///
00002 /// @file Renderer.hpp
00003 /// @brief This file contains the Renderer class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <cassert>
00010 #include <array>
00011
00012 #include "VEngine/Gfx/SwapChain.hpp"
00013
00014 namespace ven {
00015
00016     static constexpr VkClearColorValue DEFAULT_CLEAR_COLOR = {{0.0F, 0.0F, 0.0F, 1.0F}};
00017     static constexpr VkClearDepthStencilValue DEFAULT_CLEAR_DEPTH = {1.0F, 0};
00018
00019     ///
00020     /// @class Renderer
00021     /// @brief Class for renderer
00022     /// @namespace ven
00023     ///
00024     class Renderer {
00025
00026     public:
00027
00028         Renderer(Window &window, Device &device) : m_window{window}, m_device{device} {
00029             recreateSwapChain(); createCommandBuffers(); }
00030         ~Renderer() { freeCommandBuffers(); }
00031
00032         Renderer(const Renderer &) = delete;
00033         Renderer& operator=(const Renderer &) = delete;
00034
00035         [[nodiscard]] VkRenderPass getSwapChainRenderPass() const { return
00036             m_swapChain->getRenderPass(); }
00037         [[nodiscard]] float getAspectRatio() const { return m_swapChain->extentAspectRatio(); }
00038         [[nodiscard]] bool isFrameInProgress() const { return m_isFrameStarted; }
00039         [[nodiscard]] VkCommandBuffer getCurrentCommandBuffer() const { assert(isFrameInProgress())
00040             && "cannot get command m_buffer when frame not in progress"; return
00041             m_commandBuffers[static_cast<unsigned long>(m_currentFrameIndex)]; }
00042
00043         [[nodiscard]] unsigned long getFrameIndex() const { assert(isFrameInProgress()) && "cannot
00044             get frame index when frame not in progress"; return m_currentFrameIndex; }
00045         [[nodiscard]] std::array<float, 4> getClearColor() const { return {
00046             m_clearValues[0].color.float32[0],
00047             m_clearValues[0].color.float32[1],
00048             m_clearValues[0].color.float32[2],
00049             m_clearValues[0].color.float32[3]
00050         }; }
00051
00052         [[nodiscard]] Window& getWindow() const { return m_window; }
00053
00054         void setClearValue(const VkClearColorValue clearColorValue = DEFAULT_CLEAR_COLOR, const
00055             VkClearDepthStencilValue clearDepthValue = DEFAULT_CLEAR_DEPTH) { m_clearValues[0].color =
00056             clearColorValue; m_clearValues[1].depthStencil = clearDepthValue; }
00057         void beginFrame();
00058         void endFrame();
00059         void beginSwapChainRenderPass(VkCommandBuffer commandBuffer) const;
00060         void endSwapChainRenderPass(VkCommandBuffer commandBuffer) const;
```

```

00054
00055     private:
00056
00057         void createCommandBuffers();
00058         void freeCommandBuffers();
00059         void recreateSwapChain();
00060
00061         Window &m_window;
00062         Device &m_device;
00063         std::unique_ptr<SwapChain> m_swapChain;
00064         std::vector<VkCommandBuffer> m_commandBuffers;
00065         std::array<VkClearColorValue, 2> m_clearValues{DEFAULT_CLEAR_COLOR, 1.0F, 0.F};
00066
00067         uint32_t m_currentImageIndex{0};
00068         unsigned long m_currentFrameIndex{0};
00069         bool m_isFrameStarted{false};
00070
00071     }; // class Renderer
00072
00073 } // namespace ven

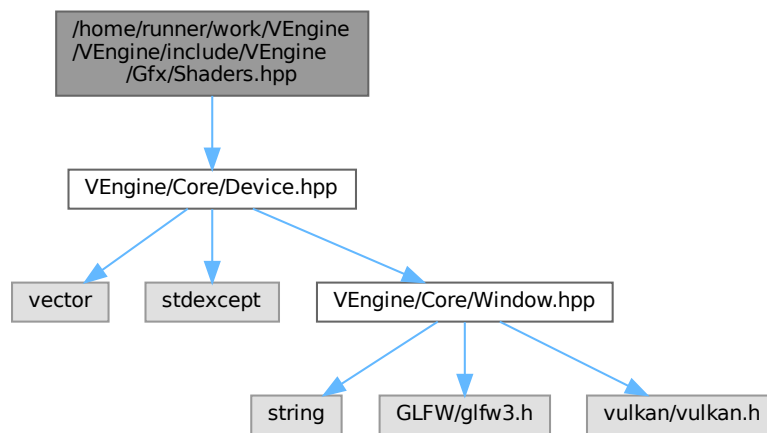
```

8.41 /home/runner/work/VEngine/VEngine/include/VEngine/Gfx/ Shaders.hpp File Reference

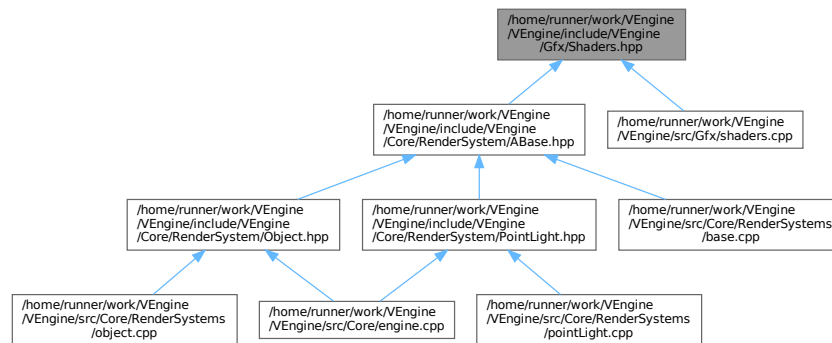
This file contains the Shader class.

```
#include "VEngine/Core/Device.hpp"
```

Include dependency graph for Shaders.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct `ven::PipelineConfigInfo`
- class `ven::Shaders`

Class for shaders.

Namespaces

- namespace `ven`

Variables

- static constexpr std::string_view `ven::SHADERS_BIN_PATH` = "build/shaders/"

8.41.1 Detailed Description

This file contains the Shader class.

Definition in file [Shaders.hpp](#).

8.42 Shaders.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file Shaders.hpp
00003 /// @brief This file contains the Shader class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include "VEngine/Core/Device.hpp"
00010
00011 namespace ven {
00012
00013     static constexpr std::string_view SHADERS_BIN_PATH = "build/shaders/";
00014

```

```

00015     struct PipelineConfigInfo {
00016         PipelineConfigInfo() = default;
00017         PipelineConfigInfo(const PipelineConfigInfo&) = delete;
00018         PipelineConfigInfo& operator=(const PipelineConfigInfo&) = delete;
00019
00020         std::vector<VkVertexInputBindingDescription> bindingDescriptions;
00021         std::vector<VkVertexInputAttributeDescription> attributeDescriptions;
00022         VkPipelineInputAssemblyStateCreateInfo inputAssemblyInfo{};
00023         VkPipelineRasterizationStateCreateInfo rasterizationInfo{};
00024         VkPipelineMultisampleStateCreateInfo multisampleInfo{};
00025         VkPipelineColorBlendAttachmentState colorBlendAttachment{};
00026         VkPipelineColorBlendStateCreateInfo colorBlendInfo{};
00027         VkPipelineDepthStencilStateCreateInfo depthStencilInfo{};
00028         std::vector<VkDynamicState> dynamicStateEnables;
00029         VkPipelineDynamicStateCreateInfo dynamicStateInfo{};
00030         VkPipelineLayout pipelineLayout = nullptr;
00031         VkRenderPass renderPass = nullptr;
00032         uint32_t subpass = 0;
00033     };
00034
00035     ///
00036     /// @class Shaders
00037     /// @brief Class for shaders
00038     /// @namespace ven
00039     ///
00040     class Shaders {
00041
00042     public:
00043
00044         Shaders(Device &device, const std::string& vertFilepath, const std::string& fragFilepath,
00045 const PipelineConfigInfo& configInfo) : m_device{device} { createGraphicsPipeline(vertFilepath,
00046 fragFilepath, configInfo); };
00047         ~Shaders();
00048
00049         Shaders(const Shaders&) = delete;
00050         Shaders& operator=(const Shaders&) = delete;
00051
00052         static void defaultPipelineConfigInfo(PipelineConfigInfo& configInfo);
00053         void bind(const VkCommandBuffer commandBuffer) const { vkCmdBindPipeline(commandBuffer,
00054 VK_PIPELINE_BIND_POINT_GRAPHICS, m_graphicsPipeline); }
00055
00056     private:
00057
00058         static std::vector<char> readFile(const std::string &filename);
00059         void createGraphicsPipeline(const std::string& vertFilepath, const std::string&
00060 fragFilepath, const PipelineConfigInfo& configInfo);
00061         void createShaderModule(const std::vector<char>& code, VkShaderModule* shaderModule)
00062 const;
00063
00064         Device& m_device;
00065         VkPipeline m_graphicsPipeline{nullptr};
00066         VkShaderModule m_vertShaderModule{nullptr};
00067         VkShaderModule m_fragShaderModule{nullptr};
00068
00069     }; // class Shaders
00070
00071 } // namespace ven

```

8.43 /home/runner/work/VEngine/VEngine/include/VEngine/Gfx/SwapChain.hpp File Reference

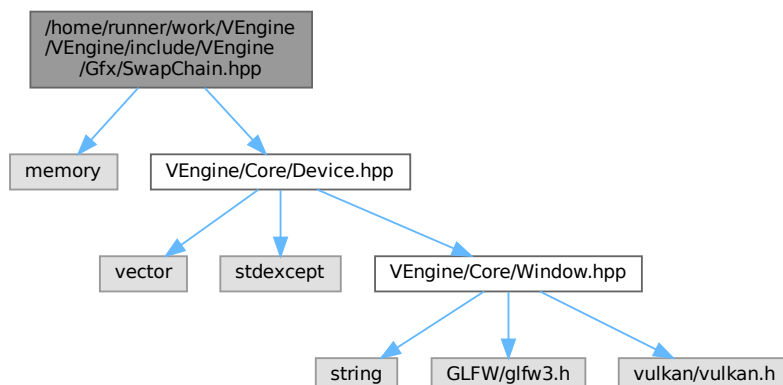
This file contains the Shader class.

```

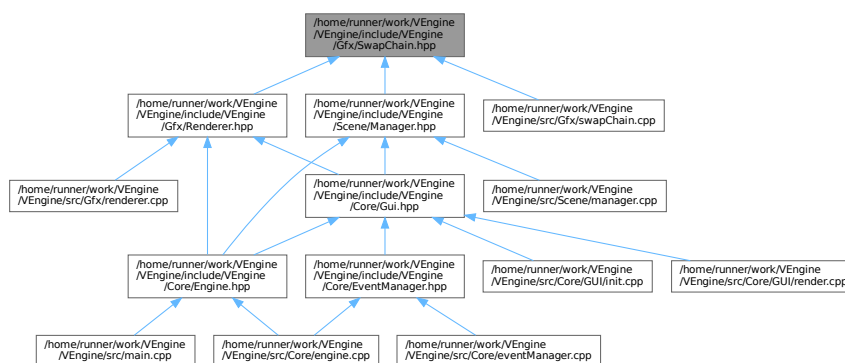
#include <memory>
#include "VEngine/Core/Device.hpp"

```


Include dependency graph for SwapChain.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class `ven::SwapChain`
Class for swap chain.

Namespaces

- namespace `ven`

Variables

- static constexpr int `ven::MAX_FRAMES_IN_FLIGHT` = 2

8.43.1 Detailed Description

This file contains the Shader class.

Definition in file [SwapChain.hpp](#).

8.44 SwapChain.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file SwapChain.hpp
00003 /// @brief This file contains the Shader class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <memory>
00010
00011 #include "VEngine/Core/Device.hpp"
00012
00013 namespace ven {
00014
00015     static constexpr int MAX_FRAMES_IN_FLIGHT = 2;
00016
00017     ///
00018     /// @class SwapChain
00019     /// @brief Class for swap chain
00020     /// @namespace ven
00021     ///
00022     class SwapChain {
00023
00024     public:
00025
00026         SwapChain(Device &deviceRef, const VkExtent2D windowExtentRef) : m_device{deviceRef},
00027         m_windowExtent{windowExtentRef} { init(); }
00028         SwapChain(Device &deviceRef, const VkExtent2D windowExtentRef, std::shared_ptr<SwapChain>
00029         previous) : m_device{deviceRef}, m_windowExtent{windowExtentRef}, m_oldSwapChain{std::move(previous)}
00030         { init(); m_oldSwapChain = nullptr; }
00031         ~SwapChain();
00032
00033         SwapChain(const SwapChain &) = delete;
00034         SwapChain& operator=(const SwapChain &) = delete;
00035
00036         [[nodiscard]] VkFramebuffer getFramebuffer(const unsigned long index) const { return
00037         m_swapChainFrameBuffers[index]; }
00038         [[nodiscard]] VkRenderPass getRenderPass() const { return m_renderPass; }
00039         [[nodiscard]] VkImageView getImageView(const int index) const { return
00040         m_swapChainImageViews[static_cast<unsigned long>(index)]; }
00041         [[nodiscard]] size_t imageCount() const { return m_swapChainImages.size(); }
00042         [[nodiscard]] VkFormat getSwapChainImageFormat() const { return m_swapChainImageFormat; }
00043         [[nodiscard]] VkExtent2D getSwapChainExtent() const { return m_swapChainExtent; }
00044         [[nodiscard]] uint32_t width() const { return m_swapChainExtent.width; }
00045         [[nodiscard]] uint32_t height() const { return m_swapChainExtent.height; }
00046
00047         [[nodiscard]] float extentAspectRatio() const { return
00048         static_cast<float>(m_swapChainExtent.width) / static_cast<float>(m_swapChainExtent.height); }
00049         [[nodiscard]] VkFormat findDepthFormat() const;
00050
00051         VkResult acquireNextImage(uint32_t *imageIndex) const;
00052         VkResult submitCommandBuffers(const VkCommandBuffer *buffers, const uint32_t *imageIndex);
00053
00054         [[nodiscard]] bool compareSwapFormats(const SwapChain &swapChain) const { return
00055         m_swapChainImageFormat == swapChain.m_swapChainImageFormat && m_swapChainDepthFormat ==
00056         swapChain.m_swapChainDepthFormat; }
00057
00058     private:
00059
00060         void init();
00061         void createSwapChain();
00062         void createImageViews();
00063         void createDepthResources();
00064         void createRenderPass();
00065         void createFrameBuffers();
00066         void createSyncObjects();
00067
00068         static VkSurfaceFormatKHR chooseSwapSurfaceFormat(const std::vector<VkSurfaceFormatKHR>
00069         &availableFormats);

```

```

00061         static VkPresentModeKHR chooseSwapPresentMode(const std::vector<VkPresentModeKHR>
&availablePresentModes);
00062         [[nodiscard]] VkExtent2D chooseSwapExtent(const VkSurfaceCapabilitiesKHR &capabilities)
const;
00063
00064         VkFormat m_swapChainImageFormat{};
00065         VkFormat m_swapChainDepthFormat{};
00066         VkExtent2D m_swapChainExtent{};
00067
00068         std::vector<VkFramebuffer> m_swapChainFrameBuffers;
00069         VkRenderPass m_renderPass{};
00070
00071         std::vector<VkImage> m_depthImages;
00072         std::vector<VkDeviceMemory> m_depthImageMemory;
00073         std::vector<VkImageView> m_depthImageViews;
00074         std::vector<VkImage> m_swapChainImages;
00075         std::vector<VkImageView> m_swapChainImageViews;
00076
00077         Device &m_device;
00078         VkExtent2D m_windowExtent;
00079
00080         VkSwapchainKHR m_swapChain{};
00081         std::shared_ptr<SwapChain> m_oldSwapChain;
00082
00083         std::vector<VkSemaphore> m_imageAvailableSemaphores;
00084         std::vector<VkSemaphore> m_renderFinishedSemaphores;
00085         std::vector<VkFence> m_inFlightFences;
00086         std::vector<VkFence> m_imagesInFlight;
00087         size_t m_currentFrame{0};
00088
00089     }; // class SwapChain
00090
00091 } // namespace ven

```

8.45 /home/runner/work/VEngine/VEngine/include/VEngine/Gfx/Texture.hpp File Reference

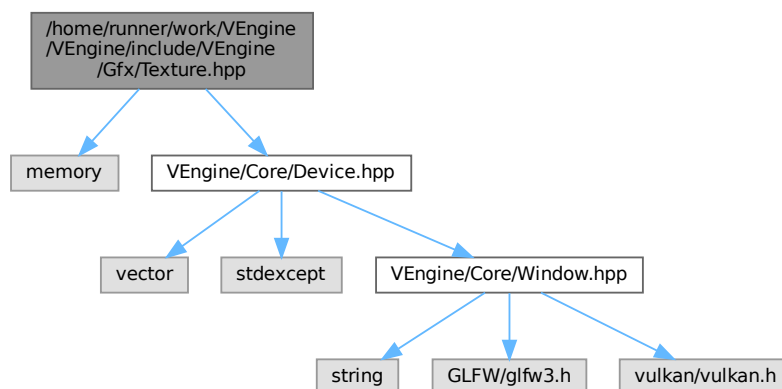
This file contains the Texture class.

```

#include <memory>
#include "VEngine/Core/Device.hpp"

```

Include dependency graph for Texture.hpp:




```

00025         Texture(Device &device, VkFormat format, VkExtent3D extent, VkImageUsageFlags usage,
VkSampleCountFlagBits sampleCount);
00026         ~Texture();
00027
00028         Texture(const Texture &) = delete;
00029         Texture &operator=(const Texture &) = delete;
00030
00031         static std::unique_ptr<Texture> createTextureFromFile(Device &device, const std::string
&filepath) { return std::make_unique<Texture>(device, filepath); }
00032
00033         void updateDescriptor();
00034         void transitionLayout(VkCommandBuffer commandBuffer, VkImageLayout oldLayout,
VkImageLayout newLayout) const;
00035
00036         [[nodiscard]] VkImageView imageView() const { return m_textureImageView; }
00037         [[nodiscard]] VkSampler sampler() const { return m_textureSampler; }
00038         [[nodiscard]] VkImage getImage() const { return m_textureImage; }
00039         [[nodiscard]] VkImageView getImageView() const { return m_textureImageView; }
00040         [[nodiscard]] VkDescriptorImageInfo getImageInfo() const { return m_descriptor; }
00041         [[nodiscard]] VkImageLayout getImageLayout() const { return m_textureLayout; }
00042         [[nodiscard]] VkExtent3D getExtent() const { return m_extent; }
00043         [[nodiscard]] VkFormat getFormat() const { return m_format; }
00044
00045     private:
00046
00047         void createTextureImage(const std::string &filepath);
00048         void createTextureImageView(VkImageViewType viewType);
00049         void createTextureSampler();
00050
00051         VkDescriptorImageInfo m_descriptor{};
00052         Device &m_device;
00053         VkImage m_textureImage = nullptr;
00054         VkDeviceMemory m_textureImageMemory = nullptr;
00055         VkImageView m_textureImageView = nullptr;
00056         VkSampler m_textureSampler = nullptr;
00057         VkFormat m_format;
00058         VkImageLayout m_textureLayout{};
00059         uint32_t m_mipLevels{1};
00060         uint32_t m_layerCount{1};
00061         VkExtent3D m_extent{};
00062
00063     }; // class Texture
00064
00065 } // namespace ven

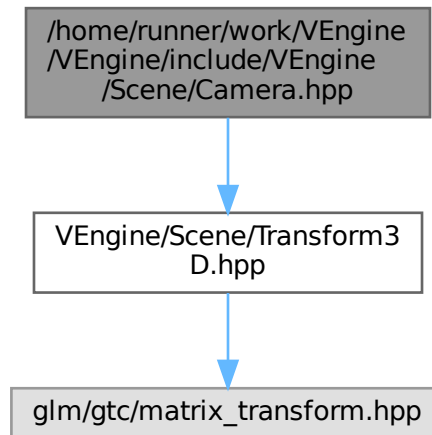
```

8.47 /home/runner/work/VEngine/VEngine/include/VEngine/Scene/Camera.hpp File Reference

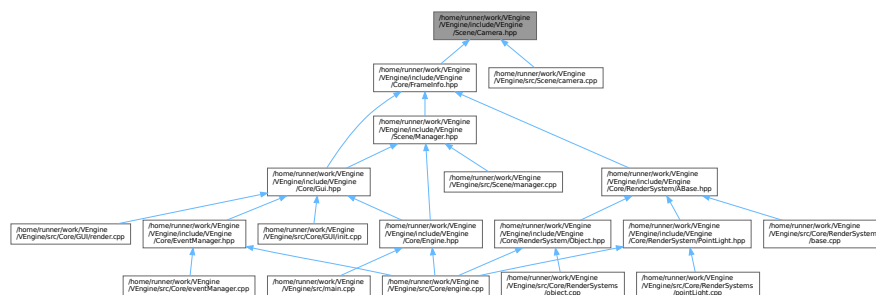
This file contains the Camera class.

```
#include "VEngine/Scene/Transform3D.hpp"
```

Include dependency graph for Camera.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class [ven::Camera](#)
Class for camera.

Namespaces

- namespace [ven](#)

Variables

- static constexpr glm::vec3 [ven::DEFAULT_POSITION](#) {0.F, 0.F, -2.5F}
- static constexpr glm::vec3 [ven::DEFAULT_ROTATION](#) {0.F, 0.F, 0.F}
- static constexpr float [ven::DEFAULT_FOV](#) = glm::radians(50.0F)
- static constexpr float [ven::DEFAULT_NEAR](#) = 0.1F
- static constexpr float [ven::DEFAULT_FAR](#) = 100.F
- static constexpr float [ven::DEFAULT_MOVE_SPEED](#) = 3.F
- static constexpr float [ven::DEFAULT_LOOK_SPEED](#) = 1.5F

8.47.1 Detailed Description

This file contains the Camera class.

Definition in file [Camera.hpp](#).

8.48 Camera.hpp

[Go to the documentation of this file.](#)

```
00001 ///
00002 /// @file Camera.hpp
00003 /// @brief This file contains the Camera class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include "VEngine/Scene/Transform3D.hpp"
00010
00011 namespace ven {
00012
00013     static constexpr glm::vec3 DEFAULT_POSITION{0.F, 0.F, -2.5F};
00014     static constexpr glm::vec3 DEFAULT_ROTATION{0.F, 0.F, 0.F};
00015
00016     static constexpr float DEFAULT_FOV = glm::radians(50.0F);
00017     static constexpr float DEFAULT_NEAR = 0.1F;
00018     static constexpr float DEFAULT_FAR = 100.F;
00019
00020     static constexpr float DEFAULT_MOVE_SPEED = 3.F;
00021     static constexpr float DEFAULT_LOOK_SPEED = 1.5F;
00022
00023     ///
00024     /// @class Camera
00025     /// @brief Class for camera
00026     /// @namespace ven
00027     ///
00028     class Camera {
00029
00030     public:
00031
00032         Camera() = default;
00033         ~Camera() = default;
00034
00035         Camera(const Camera&) = delete;
00036         Camera& operator=(const Camera&) = delete;
00037
00038         void setOrthographicProjection(float left, float right, float top, float bottom, float
near, float far);
00039         void setPerspectiveProjection(float aspect);
00040         void setViewDirection(glm::vec3 position, glm::vec3 direction, glm::vec3 up = {0.F, -1.F,
0.F});
00041         void setViewTarget(const glm::vec3 position, const glm::vec3 target, const glm::vec3 up =
{0.F, -1.F, 0.F}) { setViewDirection(position, target - position, up); }
00042         void setViewXYZ(glm::vec3 position, glm::vec3 rotation);
00043         void setFov(const float fov) { m_fov = fov; }
00044         void setNear(const float near) { m_near = near; }
00045         void setFar(const float far) { m_far = far; }
00046         void setMoveSpeed(const float moveSpeed) { m_moveSpeed = moveSpeed; }
00047         void setLookSpeed(const float lookSpeed) { m_lookSpeed = lookSpeed; }
00048
00049         [[nodiscard]] const glm::mat4& getProjection() const { return m_projectionMatrix; }
00050         [[nodiscard]] const glm::mat4& getView() const { return m_viewMatrix; }
00051         [[nodiscard]] const glm::mat4& getInverseView() const { return m_inverseViewMatrix; }
00052         [[nodiscard]] float getFov() const { return m_fov; }
00053         [[nodiscard]] float getNear() const { return m_near; }
00054         [[nodiscard]] float getFar() const { return m_far; }
00055         [[nodiscard]] float getMoveSpeed() const { return m_moveSpeed; }
00056         [[nodiscard]] float getLookSpeed() const { return m_lookSpeed; }
00057
00058         Transform3D transform(DEFAULT_POSITION, {1.F, 1.F, 1.F}, DEFAULT_ROTATION);
00059
00060     private:
00061
00062         float m_fov{DEFAULT_FOV};
00063         float m_near{DEFAULT_NEAR};
00064         float m_far{DEFAULT_FAR};
00065         float m_moveSpeed{DEFAULT_MOVE_SPEED};
00066         float m_lookSpeed{DEFAULT_LOOK_SPEED};

```


Namespaces

- namespace [ven](#)

Variables

- static constexpr float [ven::DEFAULT_LIGHT_INTENSITY](#) = .2F
- static constexpr float [ven::DEFAULT_LIGHT_RADIUS](#) = 0.1F
- static constexpr float [ven::DEFAULT_SHININESS](#) = 32.F
- static constexpr glm::vec4 [ven::DEFAULT_LIGHT_COLOR](#) = {glm::vec3(1.F), [DEFAULT_LIGHT_INTENSITY](#)}
- static constexpr uint8_t [ven::MAX_LIGHTS](#) = 10

8.49.1 Detailed Description

This file contains the Light class.

Definition in file [Light.hpp](#).

8.50 Light.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file Light.hpp
00003 /// @brief This file contains the Light class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include "VEngine/Scene/Transform3D.hpp"
00010
00011 namespace ven {
00012
00013     static constexpr float DEFAULT_LIGHT_INTENSITY = .2F;
00014     static constexpr float DEFAULT_LIGHT_RADIUS = 0.1F;
00015     static constexpr float DEFAULT_SHININESS = 32.F;
00016     static constexpr glm::vec4 DEFAULT_LIGHT_COLOR = {glm::vec3(1.F), DEFAULT_LIGHT_INTENSITY};
00017
00018     static constexpr uint8_t MAX_LIGHTS = 10;
00019
00020     ///
00021     /// @class Light
00022     /// @brief Class for light
00023     /// @namespace ven
00024     ///
00025     class Light {
00026
00027     public:
00028
00029         using Map = std::unordered_map<unsigned int, Light>;
00030
00031         explicit Light(const unsigned int objId) : m_lightId{objId} {}
00032
00033         ~Light() = default;
00034
00035         Light(const Light&) = delete;
00036         Light& operator=(const Light&) = delete;
00037         Light(Light&&) = default;
00038         Light& operator=(Light&&) = default;
00039
00040         [[nodiscard]] unsigned int getId() const { return m_lightId; }
00041         [[nodiscard]] std::string getName() const { return m_name; }
00042         [[nodiscard]] float getShininess() const { return m_shininess; }
00043
00044         void setName(const std::string &name) { m_name = name; }
00045         void setShininess(const float shininess) { m_shininess = shininess; }
00046
00047         glm::vec4 color{DEFAULT_LIGHT_COLOR};

```

```

00048         Transform3D transform{};
00049
00050     private:
00051
00052         unsigned int m_lightId;
00053         std::string m_name{"point light"};
00054         float m_shininess{DEFAULT_SHININESS};
00055
00056     }; // class Light
00057
00058 } // namespace ven

```

8.51 /home/runner/work/VEngine/VEngine/include/VEngine/Scene/Manager.hpp File Reference

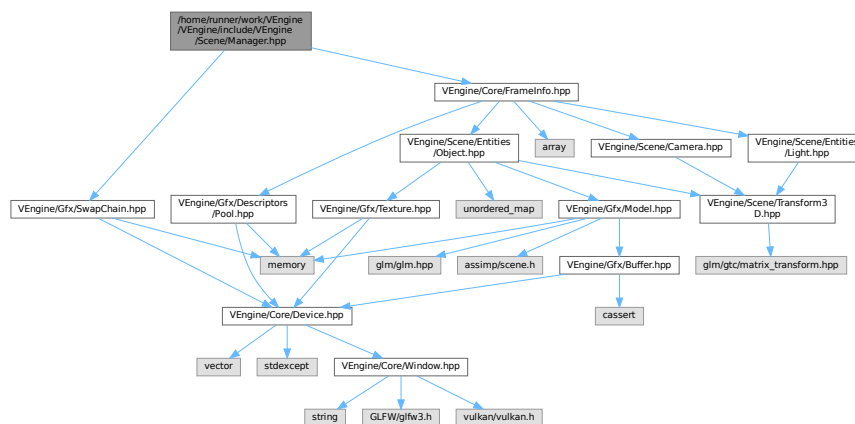
This file contains the SceneManager class.

```

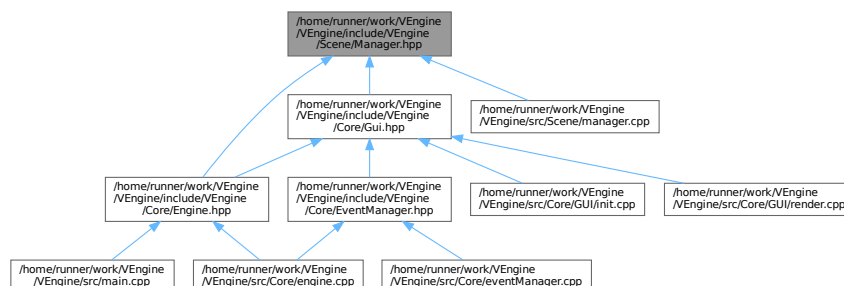
#include "VEngine/Core/FrameInfo.hpp"
#include "VEngine/Gfx/SwapChain.hpp"

```

Include dependency graph for Manager.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class `ven::SceneManager`
Class for object manager.

Namespaces

- namespace [ven](#)

8.51.1 Detailed Description

This file contains the SceneManager class.

Definition in file [Manager.hpp](#).

8.52 Manager.hpp

[Go to the documentation of this file.](#)

```
00001 ///
00002 /// @file Manager.hpp
00003 /// @brief This file contains the SceneManager class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include "VEngine/Core/FrameInfo.hpp"
00010 #include "VEngine/Gfx/SwapChain.hpp"
00011
00012 namespace ven {
00013
00014     ///
00015     /// @class SceneManager
00016     /// @brief Class for object manager
00017     /// @namespace ven
00018     ///
00019     class SceneManager {
00020
00021     public:
00022
00023         explicit SceneManager(Device &device);
00024
00025         SceneManager(const SceneManager &) = delete;
00026         SceneManager &operator=(const SceneManager &) = delete;
00027         SceneManager(SceneManager &&) = delete;
00028         SceneManager &operator=(SceneManager &&) = delete;
00029
00030         Object& createObject();
00031         Object& duplicateObject(unsigned int objectId);
00032         Light& createLight(float radius = DEFAULT_LIGHT_RADIUS, glm::vec4 color =
DEFAULT_LIGHT_COLOR);
00033         Light& duplicateLight(unsigned int lightId);
00034
00035         void destroyObject(const unsigned int objectId) { m_objects.erase(objectId); }
00036         void destroyLight(const unsigned int lightId) { m_lights.erase(lightId); }
00037         void destroyEntity(std::vector<unsigned int> *objectsIds, std::vector<unsigned int>
*lightsIds);
00038
00039         void updateBuffer(GlobalUbo &ubo, unsigned long frameIndex, float frameTime);
00040
00041         VkDescriptorBufferInfo getBufferInfoForObject(const int frameIndex, const unsigned int
objectId) const { return m_uboBuffers.at(static_cast<long unsigned
int>(frameIndex))->descriptorInfoForIndex(objectId); }
00042         Object::Map& getObjects() { return m_objects; }
00043         Light::Map& getLights() { return m_lights; }
00044         std::vector<std::unique_ptr<Buffer>> &getUboBuffers() { return m_uboBuffers; }
00045         bool getDestroyState() const { return m_destroyState; }
00046
00047         void setDestroyState(const bool state) { m_destroyState = state; }
00048
00049     private:
00050
00051         unsigned int m_currentObjId{0};
00052         unsigned int m_currentLightId{0};
00053         std::shared_ptr<Texture> m_textureDefault;
00054         Object::Map m_objects;
00055         Light::Map m_lights;
00056         std::vector<std::unique_ptr<Buffer>> m_uboBuffers{MAX_FRAMES_IN_FLIGHT};
00057         bool m_destroyState{false};
00058
00059     }; // class SceneManager
00060
00061 } // namespace ven
```


8.54 Transform3D.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file Transform3D.hpp
00003 /// @brief This file contains the Transform3D class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <glm/gtc/matrix_transform.hpp>
00010
00011 namespace ven {
00012
00013     ///
00014     /// @class Transform3D
00015     /// @brief Class for 3D transformation
00016     /// @namespace ven
00017     ///
00018     class Transform3D {
00019     public:
00020
00021         [[nodiscard]] glm::mat4 transformMatrix() const {
00022             auto rotationMatrix = glm::mat4(1.0F);
00023
00024             rotationMatrix = rotate(rotationMatrix, rotation.x, glm::vec3(1.0F, 0.0F, 0.0F));
00025             rotationMatrix = rotate(rotationMatrix, rotation.y, glm::vec3(0.0F, 1.0F, 0.0F));
00026             rotationMatrix = rotate(rotationMatrix, rotation.z, glm::vec3(0.0F, 0.0F, 1.0F));
00027
00028             const glm::mat4 scaleMatrix = glm::scale(glm::mat4(1.0F), scale);
00029             const glm::mat4 translationMatrix = translate(glm::mat4(1.0F), translation);
00030
00031             return translationMatrix * rotationMatrix * scaleMatrix;
00032         }
00033
00034         [[nodiscard]] glm::mat3 normalMatrix() const { return
transpose(inverse(glm::mat3(transformMatrix()))); }
00035
00036         glm::vec3 translation{};
00037         glm::vec3 scale{1.F, 1.F, 1.F};
00038         glm::vec3 rotation{};
00039
00040     }; // class Transform3D
00041
00042 } // namespace ven

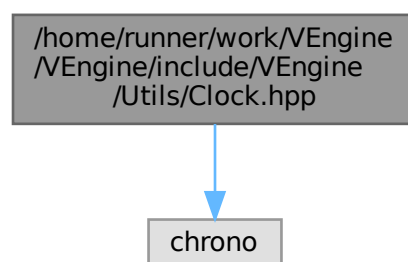
```

8.55 /home/runner/work/VEngine/VEngine/include/VEngine/Utils/Clock.hpp File Reference

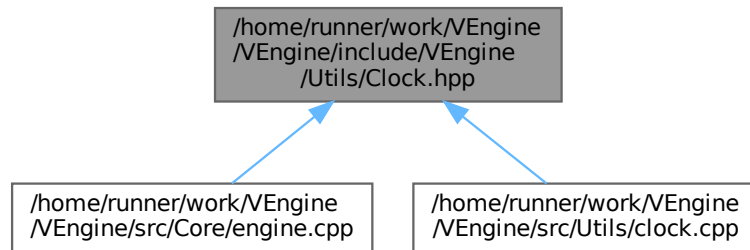
This file contains the Clock class.

```
#include <chrono>
```

Include dependency graph for Clock.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class [ven::Clock](#)
Class for clock.

Namespaces

- namespace [ven](#)

Typedefs

- using [ven::TimePoint](#) = `std::chrono::time_point<std::chrono::high_resolution_clock>`

8.55.1 Detailed Description

This file contains the Clock class.

Definition in file [Clock.hpp](#).

8.56 Clock.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file Clock.hpp
00003 /// @brief This file contains the Clock class
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <chrono>
00010
00011 namespace ven {
00012
00013     using TimePoint = std::chrono::time_point<std::chrono::high_resolution_clock>;
00014
00015     ///
00016     /// @class Clock
  
```

```

00017     /// @brief Class for clock
00018     /// @namespace ven
00019     ///
00020     class Clock {
00021     public:
00022         Clock() { start(); }
00023         ~Clock() = default;
00024         Clock(const Clock&) = delete;
00025         Clock& operator=(const Clock&) = delete;
00026
00027         void start() { m_startTime = std::chrono::high_resolution_clock::now(); }
00028         void stop();
00029         void resume();
00030         void update();
00031
00032         [[nodiscard]] float getDeltaTime() const { return m_deltaTime.count(); }
00033         [[nodiscard]] float getDeltaTimeMS() const { return m_deltaTime.count() * 1000.F; }
00034         [[nodiscard]] float getFPS() const { return 1.F / m_deltaTime.count(); }
00035
00036     private:
00037         TimePoint m_startTime;
00038         TimePoint m_stopTime;
00039         std::chrono::duration<float> m_deltaTime{0.F};
00040
00041         bool m_isStopped{false};
00042     }; // class Clock
00043 } // namespace ven

```

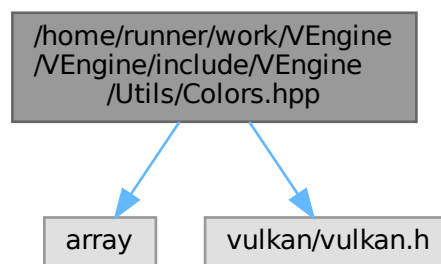
8.57 /home/runner/work/VEngine/VEngine/include/VEngine/Utils/Colors.hpp File Reference

```

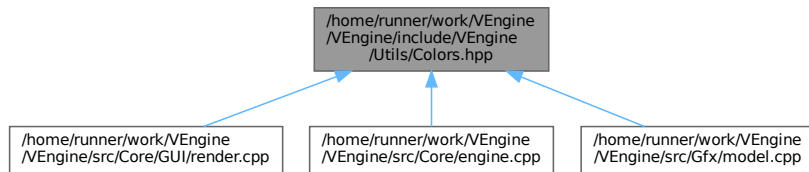
#include <array>
#include <vulkan/vulkan.h>

```

Include dependency graph for Colors.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class [ven::Colors](#)
Class for colors.

Namespaces

- namespace [ven](#)

Variables

- static constexpr float [ven::COLOR_MAX](#) = 255.0F

8.58 Colors.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file Colors.hpp
00003 /// @brief
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <array>
00010
00011 #include <vulkan/vulkan.h>
00012
00013 namespace ven {
00014
00015     static constexpr float COLOR_MAX = 255.0F;
00016
00017     ///
00018     /// @class Colors
00019     /// @brief Class for colors
00020     /// @namespace ven
00021     ///
00022     class Colors {
00023     public:
00024
00025         static constexpr glm::vec3 WHITE_3 = glm::vec3(COLOR_MAX) / COLOR_MAX;
00026         static constexpr glm::vec4 WHITE_4 = { 1.0F, 1.0F, 1.0F, 1.0F };
00027         static constexpr VkClearColorValue WHITE_V = { { 1.0F, 1.0F, 1.0F, 1.0F } };
00028
00029         static constexpr glm::vec3 BLACK_3 = glm::vec3(0.0F);
00030         static constexpr glm::vec4 BLACK_4 = { 0.0F, 0.0F, 0.0F, 1.0F };
00031         static constexpr VkClearColorValue BLACK_V = { { 0.0F, 0.0F, 0.0F, 1.0F } };
00032
00033         static constexpr glm::vec3 RED_3 = glm::vec3(COLOR_MAX, 0.0F, 0.0F) / COLOR_MAX;
00034
  
```



```

00035     static constexpr glm::vec4 RED_4 = { 1.0F, 0.0F, 0.0F, 1.0F };
00036     static constexpr VkClearColorValue RED_V = { { 1.0F, 0.0F, 0.0F, 1.0F } };
00037
00038     static constexpr glm::vec3 GREEN_3 = glm::vec3(0.0F, COLOR_MAX, 0.0F) / COLOR_MAX;
00039     static constexpr glm::vec4 GREEN_4 = { 0.0F, 1.0F, 0.0F, 1.0F };
00040     static constexpr VkClearColorValue GREEN_V = { { 0.0F, 1.0F, 0.0F, 1.0F } };
00041
00042     static constexpr glm::vec3 BLUE_3 = glm::vec3(0.0F, 0.0F, COLOR_MAX) / COLOR_MAX;
00043     static constexpr glm::vec4 BLUE_4 = { 0.0F, 0.0F, 1.0F, 1.0F };
00044     static constexpr VkClearColorValue BLUE_V = { { 0.0F, 0.0F, 1.0F, 1.0F } };
00045
00046     static constexpr glm::vec3 YELLOW_3 = glm::vec3(COLOR_MAX, COLOR_MAX, 0.0F) / COLOR_MAX;
00047     static constexpr glm::vec4 YELLOW_4 = { 1.0F, 1.0F, 0.0F, 1.0F };
00048     static constexpr VkClearColorValue YELLOW_V = { { 1.0F, 1.0F, 0.0F, 1.0F } };
00049
00050     static constexpr glm::vec3 CYAN_3 = glm::vec3(0.0F, COLOR_MAX, COLOR_MAX) / COLOR_MAX;
00051     static constexpr glm::vec4 CYAN_4 = { 0.0F, 1.0F, 1.0F, 1.0F };
00052     static constexpr VkClearColorValue CYAN_V = { { 0.0F, 1.0F, 1.0F, 1.0F } };
00053
00054     static constexpr glm::vec3 MAGENTA_3 = glm::vec3(COLOR_MAX, 0.0F, COLOR_MAX) / COLOR_MAX;
00055     static constexpr glm::vec4 MAGENTA_4 = { 1.0F, 0.0F, 1.0F, 1.0F };
00056     static constexpr VkClearColorValue MAGENTA_V = { { 1.0F, 0.0F, 1.0F, 1.0F } };
00057
00058     static constexpr glm::vec3 SILVER_3 = glm::vec3(192.0F, 192.0F, 192.0F) / COLOR_MAX;
00059     static constexpr glm::vec4 SILVER_4 = { 0.75F, 0.75F, 0.75F, 1.0F };
00060     static constexpr VkClearColorValue SILVER_V = { { 0.75F, 0.75F, 0.75F, 1.0F } };
00061
00062     static constexpr glm::vec3 GRAY_3 = glm::vec3(128.0F, 128.0F, 128.0F) / COLOR_MAX;
00063     static constexpr glm::vec4 GRAY_4 = { 0.5F, 0.5F, 0.5F, 1.0F };
00064     static constexpr VkClearColorValue GRAY_V = { { 0.5F, 0.5F, 0.5F, 1.0F } };
00065
00066     static constexpr glm::vec3 MAROON_3 = glm::vec3(128.0F, 0.0F, 0.0F) / COLOR_MAX;
00067     static constexpr glm::vec4 MAROON_4 = { 0.5F, 0.0F, 0.0F, 1.0F };
00068     static constexpr VkClearColorValue MAROON_V = { { 0.5F, 0.0F, 0.0F, 1.0F } };
00069
00070     static constexpr glm::vec3 OLIVE_3 = glm::vec3(128.0F, 128.0F, 0.0F) / COLOR_MAX;
00071     static constexpr glm::vec4 OLIVE_4 = { 0.5F, 0.5F, 0.0F, 1.0F };
00072     static constexpr VkClearColorValue OLIVE_V = { { 0.5F, 0.5F, 0.0F, 1.0F } };
00073
00074     static constexpr glm::vec3 LIME_3 = glm::vec3(0.0F, COLOR_MAX, 0.0F) / COLOR_MAX;
00075     static constexpr glm::vec4 LIME_4 = { 0.0F, 1.0F, 0.0F, 1.0F };
00076     static constexpr VkClearColorValue LIME_V = { { 0.0F, 1.0F, 0.0F, 1.0F } };
00077
00078     static constexpr glm::vec3 AQUA_3 = glm::vec3(0.0F, COLOR_MAX, COLOR_MAX) / COLOR_MAX;
00079     static constexpr glm::vec4 AQUA_4 = { 0.0F, 1.0F, 1.0F, 1.0F };
00080     static constexpr VkClearColorValue AQUA_V = { { 0.0F, 1.0F, 1.0F, 1.0F } };
00081
00082     static constexpr glm::vec3 TEAL_3 = glm::vec3(0.0F, 128.0F, 128.0F) / COLOR_MAX;
00083     static constexpr glm::vec4 TEAL_4 = { 0.0F, 0.5F, 0.5F, 1.0F };
00084     static constexpr VkClearColorValue TEAL_V = { { 0.0F, 0.5F, 0.5F, 1.0F } };
00085
00086     static constexpr glm::vec3 NAVY_3 = glm::vec3(0.0F, 0.0F, 128.0F) / COLOR_MAX;
00087     static constexpr glm::vec4 NAVY_4 = { 0.0F, 0.0F, 0.5F, 1.0F };
00088     static constexpr VkClearColorValue NAVY_V = { { 0.0F, 0.0F, 0.5F, 1.0F } };
00089
00090     static constexpr glm::vec3 FUCHSIA_3 = glm::vec3(COLOR_MAX, 0.0F, COLOR_MAX) / COLOR_MAX;
00091     static constexpr glm::vec4 FUCHSIA_4 = { 1.0F, 0.0F, 1.0F, 1.0F };
00092     static constexpr VkClearColorValue FUCHSIA_V = { { 1.0F, 0.0F, 1.0F, 1.0F } };
00093
00094     static constexpr glm::vec3 NIGHT_BLUE_3 = glm::vec3(25.0F, 25.0F, 112.0F) / COLOR_MAX;
00095     static constexpr glm::vec4 NIGHT_BLUE_4 = { 0.098F, 0.098F, 0.439F, 1.0F };
00096     static constexpr VkClearColorValue NIGHT_BLUE_V = { { 0.098F, 0.098F, 0.439F, 1.0F } };
00097
00098     static constexpr glm::vec3 SKY_BLUE_3 = glm::vec3(102.0F, 178.0F, 255.0F) / COLOR_MAX;
00099     static constexpr glm::vec4 SKY_BLUE_4 = { 0.4F, 0.698F, 1.0F, 1.0F };
00100     static constexpr VkClearColorValue SKY_BLUE_V = { { 0.4F, 0.698F, 1.0F, 1.0F } };
00101
00102     static constexpr glm::vec3 SUNSET_3 = glm::vec3(255.0F, 128.0F, 0.0F) / COLOR_MAX;
00103     static constexpr glm::vec4 SUNSET_4 = { 1.0F, 0.5F, 0.0F, 1.0F };
00104     static constexpr VkClearColorValue SUNSET_V = { { 1.0F, 0.5F, 0.0F, 1.0F } };
00105
00106
00107     static constexpr std::array<std::pair<const char *, glm::vec3>, 20> COLOR_PRESETS_3 = {{
00108         {"White", WHITE_3},
00109         {"Black", BLACK_3},
00110         {"Red", RED_3},
00111         {"Green", GREEN_3},
00112         {"Blue", BLUE_3},
00113         {"Yellow", YELLOW_3},
00114         {"Cyan", CYAN_3},
00115         {"Magenta", MAGENTA_3},
00116         {"Silver", SILVER_3},
00117         {"Gray", GRAY_3},
00118         {"Maroon", MAROON_3},
00119         {"Olive", OLIVE_3},
00120         {"Lime", LIME_3},
00121         {"Aqua", AQUA_3},

```

```

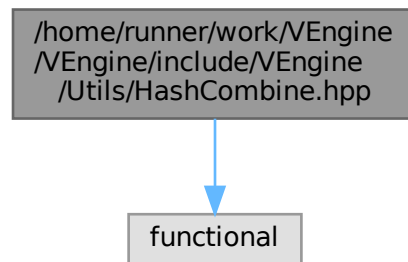
00122         {"Teal", TEAL_3},
00123         {"Navy", NAVY_3},
00124         {"Fuchsia", FUCHSIA_3},
00125         {"Night Blue", NIGHT_BLUE_3},
00126         {"Sky Blue", SKY_BLUE_3},
00127         {"Sunset", SUNSET_3}
00128     };
00129
00130     static constexpr std::array<std::pair<const char *, glm::vec4>, 20> COLOR_PRESETS_4 = {{
00131         {"White", WHITE_4},
00132         {"Black", BLACK_4},
00133         {"Red", RED_4},
00134         {"Green", GREEN_4},
00135         {"Blue", BLUE_4},
00136         {"Yellow", YELLOW_4},
00137         {"Cyan", CYAN_4},
00138         {"Magenta", MAGENTA_4},
00139         {"Silver", SILVER_4},
00140         {"Gray", GRAY_4},
00141         {"Maroon", MAROON_4},
00142         {"Olive", OLIVE_4},
00143         {"Lime", LIME_4},
00144         {"Aqua", AQUA_4},
00145         {"Teal", TEAL_4},
00146         {"Navy", NAVY_4},
00147         {"Fuchsia", FUCHSIA_4},
00148         {"Night Blue", NIGHT_BLUE_4},
00149         {"Sky Blue", SKY_BLUE_4},
00150         {"Sunset", SUNSET_4}
00151     }};
00152
00153     static constexpr std::array<std::pair<const char *, VkClearColorValue>, 20>
00154     COLOR_PRESETS_VK = {{
00155         {"White", WHITE_V},
00156         {"Black", BLACK_V},
00157         {"Red", RED_V},
00158         {"Green", GREEN_V},
00159         {"Blue", BLUE_V},
00160         {"Yellow", YELLOW_V},
00161         {"Cyan", CYAN_V},
00162         {"Magenta", MAGENTA_V},
00163         {"Silver", SILVER_V},
00164         {"Gray", GRAY_V},
00165         {"Maroon", MAROON_V},
00166         {"Olive", OLIVE_V},
00167         {"Lime", LIME_V},
00168         {"Aqua", AQUA_V},
00169         {"Teal", TEAL_V},
00170         {"Navy", NAVY_V},
00171         {"Fuchsia", FUCHSIA_V},
00172         {"Night Blue", NIGHT_BLUE_V},
00173         {"Sky Blue", SKY_BLUE_V},
00174         {"Sunset", SUNSET_V}
00175     }};
00176     }; // class Colors
00177
00178 } // namespace ven

```

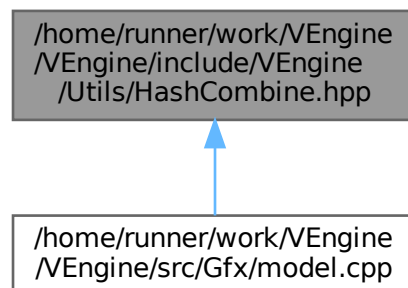
8.59 /home/runner/work/VEngine/VEngine/include/VEngine/Utils/HashCombine.hpp File Reference

```
#include <functional>
```

Include dependency graph for HashCombine.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- namespace `ven`

Functions

- `template<typename T, typename... Rest>`
`void ven::hashCombine (std::size_t &seed, const T &v, const Rest &... rest)`

8.60 HashCombine.hpp

[Go to the documentation of this file.](#)

```

00001 ///
00002 /// @file HashCombine.hpp
00003 /// @brief
00004 /// @namespace ven
00005 ///
00006
00007 #pragma once
00008
00009 #include <functional>
00010
00011 namespace ven {
00012
00013     template<typename T, typename... Rest>
00014     void hashCombine(std::size_t& seed, const T& v, const Rest&... rest) {
00015         seed ^= std::hash<T>{}(v) + 0x9e3779b9 + (seed << 6) + (seed >> 2);
00016         (hashCombine(seed, rest), ...);
00017     }
00018
00019 } // namespace ven

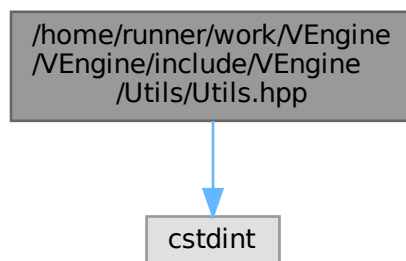
```

8.61 /home/runner/work/VEngine/VEngine/include/VEngine/Utils/Utils.hpp File Reference

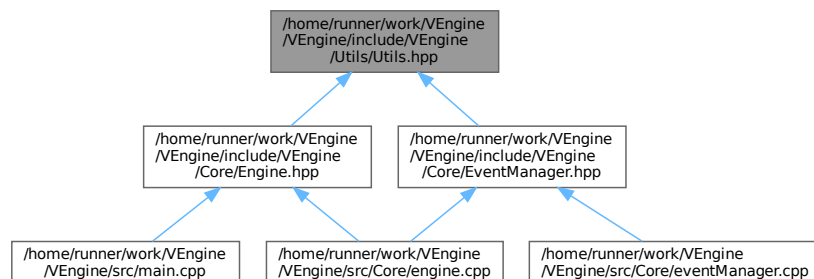
This file contains utils for VEngine.

```
#include <cstdint>
```

Include dependency graph for Utils.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- namespace [ven](#)

Enumerations

- enum [ven::ENGINE_STATE](#) : uint8_t { [ven::EDITOR](#) = 0 , [ven::PLAYER](#) = 1 , [ven::PAUSED](#) = 2 , [ven::EXIT](#) = 3 }

8.61.1 Detailed Description

This file contains utils for VEngine.

Definition in file [Utils.hpp](#).

8.62 Utils.hpp

[Go to the documentation of this file.](#)

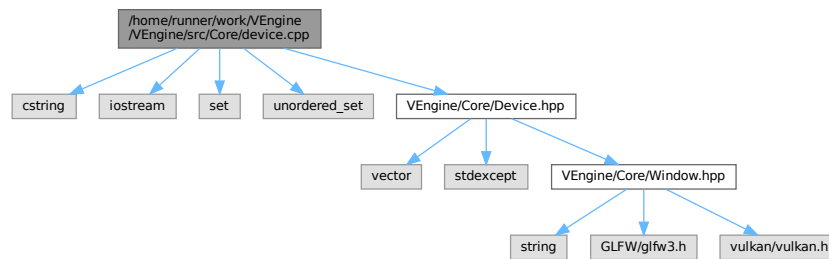
```
00001 ///  
00002 ///  
00003 ///  
00004 ///  
00005 ///  
00006 ///  
00007 #pragma once  
00008 ///  
00009 #include <cstdint>  
00010 ///  
00011 namespace ven {  
00012 ///  
00013     enum ENGINE_STATE : uint8_t {  
00014         EDITOR = 0,  
00015         PLAYER = 1,  
00016         PAUSED = 2,  
00017         EXIT = 3  
00018     };  
00019 ///  
00020 } // namespace ven
```

8.63 /home/runner/work/VEngine/VEngine/README.md File Reference

8.64 /home/runner/work/VEngine/VEngine/src/Core/device.cpp File Reference

```
#include <cstring>  
#include <iostream>  
#include <set>  
#include <unordered_set>
```

```
#include "VEngine/Core/Device.hpp"
Include dependency graph for device.cpp:
```



Functions

- static VKAPI_ATTR VkBool32 VKAPI_CALL [debugCallback](#) (const VkDebugUtilsMessageSeverityFlagBitsEXT messageSeverity, const VkDebugUtilsMessageTypeFlagsEXT messageType, const VkDebugUtilsMessengerCallbackDataEXT *pCallbackData, void *pUserData)
- VkResult [CreateDebugUtilsMessengerEXT](#) (const VkInstance instance, const VkDebugUtilsMessengerCreateInfoEXT *pCreateInfo, const VkAllocationCallbacks *pAllocator, VkDebugUtilsMessengerEXT *pDebugMessenger)
- void [DestroyDebugUtilsMessengerEXT](#) (const VkInstance instance, const VkDebugUtilsMessengerEXT debugMessenger, const VkAllocationCallbacks *pAllocator)

8.64.1 Function Documentation

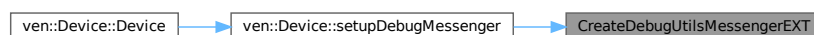
8.64.1.1 CreateDebugUtilsMessengerEXT()

```
VkResult CreateDebugUtilsMessengerEXT (
    const VkInstance instance,
    const VkDebugUtilsMessengerCreateInfoEXT * pCreateInfo,
    const VkAllocationCallbacks * pAllocator,
    VkDebugUtilsMessengerEXT * pDebugMessenger)
```

Definition at line 16 of file [device.cpp](#).

Referenced by [ven::Device::setupDebugMessenger\(\)](#).

Here is the caller graph for this function:



8.64.1.2 debugCallback()

```
static VKAPI_ATTR VkBool32 VKAPI_CALL debugCallback (
    const VkDebugUtilsMessageSeverityFlagBitsEXT messageSeverity,
    const VkDebugUtilsMessageTypeFlagsEXT messageType,
    const VkDebugUtilsMessengerCallbackDataEXT * pCallbackData,
    void * pUserData) [static]
```

Definition at line 8 of file [device.cpp](#).

Referenced by [ven::Device::populateDebugMessengerCreateInfo\(\)](#).

Here is the caller graph for this function:



8.64.1.3 DestroyDebugUtilsMessengerEXT()

```
void DestroyDebugUtilsMessengerEXT (
    const VkInstance instance,
    const VkDebugUtilsMessengerEXT debugMessenger,
    const VkAllocationCallbacks * pAllocator)
```

Definition at line 25 of file [device.cpp](#).

Referenced by [ven::Device::~~Device\(\)](#).

Here is the caller graph for this function:



8.65 device.cpp

[Go to the documentation of this file.](#)

```

00001 #include <cstring>
00002 #include <iostream>
00003 #include <set>
00004 #include <unordered_set>
00005
00006 #include "VEngine/Core/Device.hpp"
00007
00008 static VKAPI_ATTR VkBool32 VKAPI_CALL debugCallback(const VkDebugUtilsMessageSeverityFlagBitsEXT
messageSeverity, const VkDebugUtilsMessageTypeFlagsEXT messageType, const
VkDebugUtilsMessengerCallbackDataEXT *pCallbackData, void *pUserData)
00009 {
00010     (void) pUserData; (void) messageSeverity; (void) messageType;
00011
00012     std::cerr << "validation layer: " << pCallbackData->pMessage << '\n';
00013     return VK_FALSE;
00014 }
00015
00016 VkResult CreateDebugUtilsMessengerEXT(const VkInstance instance, const
VkDebugUtilsMessengerCreateInfoEXT *pCreateInfo, const VkAllocationCallbacks *pAllocator,
VkDebugUtilsMessengerEXT *pDebugMessenger)
00017 {
00018     if (const auto func =
reinterpret_cast<PFN_vkCreateDebugUtilsMessengerEXT>(vkGetInstanceProcAddr(instance,
"vkCreateDebugUtilsMessengerEXT")); func != nullptr) {
00019         return func(instance, pCreateInfo, pAllocator, pDebugMessenger);
00020     }
00021
00022     return VK_ERROR_EXTENSION_NOT_PRESENT;
00023 }
00024
00025 void DestroyDebugUtilsMessengerEXT(const VkInstance instance, const VkDebugUtilsMessengerEXT
debugMessenger, const VkAllocationCallbacks *pAllocator)
00026 {
00027     if (const auto func =
reinterpret_cast<PFN_vkDestroyDebugUtilsMessengerEXT>(vkGetInstanceProcAddr(instance,
"vkDestroyDebugUtilsMessengerEXT")); func != nullptr) {
00028         func(instance, debugMessenger, pAllocator);
00029     }
00030 }
00031
00032 ven::Device::Device(Window &window) : m_window{window}
00033 {
00034     createInstance();
00035     setupDebugMessenger();
00036     createSurface();
00037     pickPhysicalDevice();
00038     createLogicalDevice();
00039     createCommandPool();
00040 }
00041
00042 ven::Device::~Device()
00043 {
00044     vkDestroyCommandPool(m_device, m_commandPool, nullptr);
00045     vkDestroyDevice(m_device, nullptr);
00046
00047     if (enableValidationLayers) {
00048         DestroyDebugUtilsMessengerEXT(m_instance, m_debugMessenger, nullptr);
00049     }
00050
00051     vkDestroySurfaceKHR(m_instance, m_surface, nullptr);
00052     vkDestroyInstance(m_instance, nullptr);
00053 }
00054
00055 void ven::Device::createInstance()
00056 {
00057     if (enableValidationLayers && !checkValidationLayerSupport()) {
00058         throw std::runtime_error("validation layers requested, but not available!");
00059     }
00060
00061     constexpr VkApplicationInfo appInfo = {
00062         .sType = VK_STRUCTURE_TYPE_APPLICATION_INFO,
00063         .pNext = nullptr,
00064         .pApplicationName = "VEngine App",
00065         .applicationVersion = VK_MAKE_VERSION(1, 0, 0),
00066         .pEngineName = "VEngine",
00067         .engineVersion = VK_MAKE_VERSION(1, 0, 0),
00068         .apiVersion = VK_API_VERSION_1_0
00069     };
00070
00071     VkInstanceCreateInfo createInfo = {};
00072     createInfo.sType = VK_STRUCTURE_TYPE_INSTANCE_CREATE_INFO;
00073     createInfo.pApplicationInfo = &appInfo;

```



```

00074
00075     const std::vector<const char*> extensions = getRequiredExtensions();
00076     createInfo.enabledExtensionCount = static_cast<uint32_t>(extensions.size());
00077     createInfo.ppEnabledExtensionNames = extensions.data();
00078
00079     VkDebugUtilsMessengerCreateInfoEXT debugCreateInfo;
00080     if (enableValidationLayers) {
00081         createInfo.enabledLayerCount = static_cast<uint32_t>(m_validationLayers.size());
00082         createInfo.ppEnabledLayerNames = m_validationLayers.data();
00083
00084         populateDebugMessengerCreateInfo(debugCreateInfo);
00085         createInfo.pNext = &debugCreateInfo;
00086     } else {
00087         createInfo.enabledLayerCount = 0;
00088         createInfo.pNext = nullptr;
00089     }
00090
00091     if (vkCreateInstance(&createInfo, nullptr, &m_instance) != VK_SUCCESS) {
00092         throw std::runtime_error("failed to create instance!");
00093     }
00094
00095     hasGlfwRequiredInstanceExtensions();
00096 }
00097
00098 void ven::Device::pickPhysicalDevice()
00099 {
00100     uint32_t deviceCount = 0;
00101     vkEnumeratePhysicalDevices(m_instance, &deviceCount, nullptr);
00102     if (deviceCount == 0) {
00103         throw std::runtime_error("failed to find GPUs with Vulkan support!");
00104     }
00105     std::cout << "Device count: " << deviceCount << '\n';
00106     std::vector<VkPhysicalDevice> devices(deviceCount);
00107     vkEnumeratePhysicalDevices(m_instance, &deviceCount, devices.data());
00108
00109     for (const auto &device : devices) {
00110         if (isDeviceSuitable(device)) {
00111             m_physicalDevice = device;
00112             break;
00113         }
00114     }
00115
00116     if (m_physicalDevice == VK_NULL_HANDLE) {
00117         throw std::runtime_error("failed to find a suitable GPU!");
00118     }
00119
00120     vkGetPhysicalDeviceProperties(m_physicalDevice, &m_properties);
00121     std::cout << "physical device: " << m_properties.deviceName << '\n';
00122 }
00123
00124 void ven::Device::createLogicalDevice()
00125 {
00126     const auto [graphicsFamily, presentFamily, graphicsFamilyHasValue, presentFamilyHasValue] =
00127         findQueueFamilies(m_physicalDevice);
00128
00129     std::vector<VkDeviceQueueCreateInfo> queueCreateInfos;
00130     const std::set<uint32_t> uniqueQueueFamilies = {graphicsFamily, presentFamily};
00131     float queuePriority = 1.0F;
00132
00133     for (const uint32_t queueFamily : uniqueQueueFamilies) {
00134         VkDeviceQueueCreateInfo queueCreateInfo = {};
00135         queueCreateInfo.sType = VK_STRUCTURE_TYPE_DEVICE_QUEUE_CREATE_INFO;
00136         queueCreateInfo.queueFamilyIndex = queueFamily;
00137         queueCreateInfo.queueCount = 1;
00138         queueCreateInfo.pQueuePriorities = &queuePriority;
00139         queueCreateInfos.push_back(queueCreateInfo);
00140     }
00141
00142     VkPhysicalDeviceFeatures deviceFeatures = {};
00143     deviceFeatures.samplerAnisotropy = VK_TRUE;
00144
00145     VkDeviceCreateInfo createInfo = {};
00146     createInfo.sType = VK_STRUCTURE_TYPE_DEVICE_CREATE_INFO;
00147
00148     createInfo.queueCreateInfoCount = static_cast<uint32_t>(queueCreateInfos.size());
00149     createInfo.pQueueCreateInfos = queueCreateInfos.data();
00150
00151     createInfo.pEnabledFeatures = &deviceFeatures;
00152     createInfo.enabledExtensionCount = static_cast<uint32_t>(m_deviceExtensions.size());
00153     createInfo.ppEnabledExtensionNames = m_deviceExtensions.data();
00154
00155     // might not really be necessary anymore because device specific validation layers
00156     // have been deprecated
00157     if (enableValidationLayers) {
00158         createInfo.enabledLayerCount = static_cast<uint32_t>(m_validationLayers.size());
00159         createInfo.ppEnabledLayerNames = m_validationLayers.data();
00160     } else {

```

```

00160         createInfo.enabledLayerCount = 0;
00161     }
00162
00163     if (vkCreateDevice(m_physicalDevice, &createInfo, nullptr, &m_device) != VK_SUCCESS) {
00164         throw std::runtime_error("failed to create logical device!");
00165     }
00166
00167     vkGetDeviceQueue(m_device, graphicsFamily, 0, &m_graphicsQueue);
00168     vkGetDeviceQueue(m_device, presentFamily, 0, &m_presentQueue);
00169 }
00170
00171 void ven::Device::createCommandPool()
00172 {
00173     const auto [graphicsFamily, presentFamily, graphicsFamilyHasValue, presentFamilyHasValue] =
00174         findPhysicalQueueFamilies();
00175
00176     const VkCommandPoolCreateInfo poolInfo = {
00177         .sType = VK_STRUCTURE_TYPE_COMMAND_POOL_CREATE_INFO,
00178         .pNext = nullptr,
00179         .flags = VK_COMMAND_POOL_CREATE_TRANSIENT_BIT |
00180             VK_COMMAND_POOL_CREATE_RESET_COMMAND_BUFFER_BIT,
00181         .queueFamilyIndex = graphicsFamily
00182     };
00183
00184     if (vkCreateCommandPool(m_device, &poolInfo, nullptr, &m_commandPool) != VK_SUCCESS) {
00185         throw std::runtime_error("failed to create command pool!");
00186     }
00187 }
00188 bool ven::Device::isDeviceSuitable(const VkPhysicalDevice device) const
00189 {
00190     const QueueFamilyIndices indices = findQueueFamilies(device);
00191     const bool extensionsSupported = checkDeviceExtensionSupport(device);
00192     bool swapChainAdequate = false;
00193
00194     if (extensionsSupported) {
00195         auto [capabilities, formats, presentModes] = querySwapChainSupport(device);
00196         swapChainAdequate = !formats.empty() && !presentModes.empty();
00197     }
00198
00199     VkPhysicalDeviceFeatures supportedFeatures;
00200     vkGetPhysicalDeviceFeatures(device, &supportedFeatures);
00201
00202     return indices.isComplete() && extensionsSupported && swapChainAdequate &&
00203         (supportedFeatures.samplerAnisotropy != 0U);
00204 }
00205 void ven::Device::populateDebugMessengerCreateInfo(VkDebugUtilsMessengerCreateInfoEXT &createInfo)
00206 {
00207     createInfo = {};
00208     createInfo.sType = VK_STRUCTURE_TYPE_DEBUG_UTILS_MESSENGER_CREATE_INFO_EXT;
00209     createInfo.messageSeverity = VK_DEBUG_UTILS_MESSAGE_SEVERITY_WARNING_BIT_EXT |
00210         VK_DEBUG_UTILS_MESSAGE_SEVERITY_ERROR_BIT_EXT;
00211     createInfo.messageType = VK_DEBUG_UTILS_MESSAGE_TYPE_GENERAL_BIT_EXT |
00212         VK_DEBUG_UTILS_MESSAGE_TYPE_VALIDATION_BIT_EXT |
00213         VK_DEBUG_UTILS_MESSAGE_TYPE_PERFORMANCE_BIT_EXT;
00214     createInfo.pfnUserCallback = debugCallback;
00215     createInfo.pUserData = nullptr; // Optional
00216 }
00217 void ven::Device::setupDebugMessenger()
00218 {
00219     if (!enableValidationLayers) { return; }
00220     VkDebugUtilsMessengerCreateInfoEXT createInfo;
00221     populateDebugMessengerCreateInfo(createInfo);
00222     if (CreateDebugUtilsMessengerEXT(m_instance, &createInfo, nullptr, &m_debugMessenger) !=
00223         VK_SUCCESS) {
00224         throw std::runtime_error("failed to set up debug messenger!");
00225     }
00226 }
00227 bool ven::Device::checkValidationLayerSupport() const
00228 {
00229     uint32_t layerCount = 0;
00230     vkEnumerateInstanceLayerProperties(&layerCount, nullptr);
00231
00232     std::vector<VkLayerProperties> availableLayers(layerCount);
00233     vkEnumerateInstanceLayerProperties(&layerCount, availableLayers.data());
00234
00235     for (const char *validationLayer : m_validationLayers) {
00236         bool layerFound = false;
00237
00238         for (const auto &[layerName, specVersion, implementationVersion, description] :
00239             availableLayers) {
00240             if (strcmp(layerName, validationLayer) == 0) {
00241                 layerFound = true;
00242                 break;
00243             }
00244         }
00245     }
00246 }

```

```

00242     }
00243     }
00244     if (!layerFound) {
00245         return false;
00246     }
00247 }
00248
00249 return true;
00250 }
00251
00252 std::vector<const char *> ven::Device::getRequiredExtensions() const
00253 {
00254     uint32_t glfwExtensionCount = 0;
00255     const char **glfwExtensions = nullptr;
00256     glfwExtensions = glfwGetRequiredInstanceExtensions(&glfwExtensionCount);
00257
00258     std::vector<const char *> extensions(glfwExtensions, glfwExtensions + glfwExtensionCount);
00259
00260     if (enableValidationLayers) {
00261         extensions.push_back(VK_EXT_DEBUG_UTILS_EXTENSION_NAME);
00262     }
00263
00264     return extensions;
00265 }
00266
00267 void ven::Device::hasGlfwRequiredInstanceExtensions() const
00268 {
00269     uint32_t extensionCount = 0;
00270     vkEnumerateInstanceExtensionProperties(nullptr, &extensionCount, nullptr);
00271     std::vector<VkExtensionProperties> extensions(extensionCount);
00272     vkEnumerateInstanceExtensionProperties(nullptr, &extensionCount, extensions.data());
00273
00274     std::cout << "available extensions:\n";
00275     std::unordered_set<std::string> available;
00276     for (const auto &[extensionName, specVersion] : extensions) {
00277         std::cout << '\t' << extensionName << '\n';
00278         available.insert(extensionName);
00279     }
00280
00281     std::cout << "required extensions:\n";
00282     for (const std::vector<const char *> requiredExtensions = getRequiredExtensions(); const auto
&required : requiredExtensions) {
00283         std::cout << "\t" << required << '\n';
00284         if (!available.contains(required)) {
00285             throw std::runtime_error("Missing required glfw extension");
00286         }
00287     }
00288 }
00289
00290 bool ven::Device::checkDeviceExtensionSupport(const VkPhysicalDevice device) const
00291 {
00292     uint32_t extensionCount = 0;
00293     vkEnumerateDeviceExtensionProperties(device, nullptr, &extensionCount, nullptr);
00294
00295     std::vector<VkExtensionProperties> availableExtensions(extensionCount);
00296     vkEnumerateDeviceExtensionProperties(device, nullptr, &extensionCount,
availableExtensions.data());
00297
00298     std::set<std::string> requiredExtensions(m_deviceExtensions.begin(), m_deviceExtensions.end());
00299     for (const auto &[extensionName, specVersion] : availableExtensions) {
00300         requiredExtensions.erase(extensionName);
00301     }
00302
00303     return requiredExtensions.empty();
00304 }
00305
00306 ven::QueueFamilyIndices ven::Device::findQueueFamilies(const VkPhysicalDevice device) const
00307 {
00308     QueueFamilyIndices indices;
00309     uint32_t queueFamilyCount = 0;
00310     uint32_t index = 0;
00311     vkGetPhysicalDeviceQueueFamilyProperties(device, &queueFamilyCount, nullptr);
00312     std::vector<VkQueueFamilyProperties> queueFamilies(queueFamilyCount);
00313     vkGetPhysicalDeviceQueueFamilyProperties(device, &queueFamilyCount, queueFamilies.data());
00314
00315     for (const auto &[queueFlags, queueCount, timestampValidBits, minImageTransferGranularity] :
queueFamilies) {
00316         if (queueCount > 0 && ((queueFlags & VK_QUEUE_GRAPHICS_BIT) != 0U)) {
00317             indices.graphicsFamily = index;
00318             indices.graphicsFamilyHasValue = true;
00319         }
00320         VkBool32 presentSupport = 0U;
00321         vkGetPhysicalDeviceSurfaceSupportKHR(device, index, m_surface, &presentSupport);
00322         if (queueCount > 0 && (presentSupport != 0U)) {
00323             indices.presentFamily = index;
00324             indices.presentFamilyHasValue = true;
00325         }
00326     }

```

```

00326         if (indices.isComplete()) {
00327             break;
00328         }
00329         index++;
00330     }
00331     return indices;
00332 }
00333
00334 ven::SwapChainSupportDetails ven::Device::querySwapChainSupport(const VkPhysicalDevice device) const
00335 {
00336     uint32_t formatCount = 0;
00337     uint32_t presentModeCount = 0;
00338     SwapChainSupportDetails details;
00339     vkGetPhysicalDeviceSurfaceCapabilitiesKHR(device, m_surface, &details.capabilities);
00340
00341     vkGetPhysicalDeviceSurfaceFormatsKHR(device, m_surface, &formatCount, nullptr);
00342     if (formatCount != 0) {
00343         details.formats.resize(formatCount);
00344         vkGetPhysicalDeviceSurfaceFormatsKHR(device, m_surface, &formatCount, details.formats.data());
00345     }
00346     vkGetPhysicalDeviceSurfacePresentModesKHR(device, m_surface, &presentModeCount, nullptr);
00347     if (presentModeCount != 0) {
00348         details.presentModes.resize(presentModeCount);
00349         vkGetPhysicalDeviceSurfacePresentModesKHR(device, m_surface, &presentModeCount,
00350         details.presentModes.data());
00351     }
00352     return details;
00353 }
00354
00355 VkFormat ven::Device::findSupportedFormat(const std::vector<VkFormat> &candidates, const VkImageTiling
00356 tiling, const VkFormatFeatureFlags features) const
00357 {
00358     for (const VkFormat format : candidates) {
00359         VkFormatProperties props;
00360         vkGetPhysicalDeviceFormatProperties(m_physicalDevice, format, &props);
00361         if (tiling == VK_IMAGE_TILING_LINEAR && (props.linearTilingFeatures & features) == features) {
00362             return format;
00363         } if (tiling == VK_IMAGE_TILING_OPTIMAL && (props.optimalTilingFeatures & features) ==
00364         features) {
00365             return format;
00366         }
00367     }
00368     throw std::runtime_error("failed to find supported format!");
00369 }
00370
00371 uint32_t ven::Device::findMemoryType(const uint32_t typeFilter, const VkMemoryPropertyFlags
00372 properties) const
00373 {
00374     VkPhysicalDeviceMemoryProperties memProperties;
00375     vkGetPhysicalDeviceMemoryProperties(m_physicalDevice, &memProperties);
00376
00377     for (uint32_t i = 0; i < memProperties.memoryTypeCount; i++) {
00378         if (((typeFilter & (1 << i)) != 0U) &&
00379         (memProperties.memoryTypes[i].propertyFlags & properties) == properties) {
00380             return i;
00381         }
00382     }
00383     throw std::runtime_error("failed to find suitable m_memory type!");
00384 }
00385
00386 void ven::Device::createBuffer(const VkDeviceSize size, const VkBufferUsageFlags usage, const
00387 VkMemoryPropertyFlags properties, VkBuffer &buffer, VkDeviceMemory &bufferMemory) const
00388 {
00389     VkBufferCreateInfo bufferInfo{};
00390     bufferInfo.sType = VK_STRUCTURE_TYPE_BUFFER_CREATE_INFO;
00391     bufferInfo.size = size;
00392     bufferInfo.usage = usage;
00393     bufferInfo.sharingMode = VK_SHARING_MODE_EXCLUSIVE;
00394
00395     if (vkCreateBuffer(m_device, &bufferInfo, nullptr, &buffer) != VK_SUCCESS) {
00396         throw std::runtime_error("failed to create vertex m_buffer!");
00397     }
00398
00399     VkMemoryRequirements memRequirements;
00400     vkGetBufferMemoryRequirements(m_device, buffer, &memRequirements);
00401
00402     const VkMemoryAllocateInfo allocInfo{
00403         .sType = VK_STRUCTURE_TYPE_MEMORY_ALLOCATE_INFO,
00404         .pNext = nullptr,
00405         .allocationSize = memRequirements.size,
00406         .memoryTypeIndex = findMemoryType(memRequirements.memoryTypeBits, properties)
00407     };
00408
00409     if (vkAllocateMemory(m_device, &allocInfo, nullptr, &bufferMemory) != VK_SUCCESS) {
00410         throw std::runtime_error("failed to allocate vertex m_buffer m_memory!");
00411     }

```

```

00408     }
00409
00410     vkBindBufferMemory(m_device, buffer, bufferMemory, 0);
00411 }
00412
00413 VkCommandBuffer ven::Device::beginSingleTimeCommands() const
00414 {
00415     VkCommandBufferAllocateInfo allocInfo{};
00416     allocInfo.sType = VK_STRUCTURE_TYPE_COMMAND_BUFFER_ALLOCATE_INFO;
00417     allocInfo.level = VK_COMMAND_BUFFER_LEVEL_PRIMARY;
00418     allocInfo.commandPool = m_commandPool;
00419     allocInfo.commandBufferCount = 1;
00420
00421     VkCommandBuffer commandBuffer = nullptr;
00422     vkAllocateCommandBuffers(m_device, &allocInfo, &commandBuffer);
00423
00424     VkCommandBufferBeginInfo beginInfo{};
00425     beginInfo.sType = VK_STRUCTURE_TYPE_COMMAND_BUFFER_BEGIN_INFO;
00426     beginInfo.flags = VK_COMMAND_BUFFER_USAGE_ONE_TIME_SUBMIT_BIT;
00427
00428     vkBeginCommandBuffer(commandBuffer, &beginInfo);
00429     return commandBuffer;
00430 }
00431
00432 void ven::Device::endSingleTimeCommands(const VkCommandBuffer commandBuffer) const
00433 {
00434     vkEndCommandBuffer(commandBuffer);
00435
00436     VkSubmitInfo submitInfo{};
00437     submitInfo.sType = VK_STRUCTURE_TYPE_SUBMIT_INFO;
00438     submitInfo.commandBufferCount = 1;
00439     submitInfo.pCommandBuffers = &commandBuffer;
00440
00441     vkQueueSubmit(m_graphicsQueue, 1, &submitInfo, VK_NULL_HANDLE);
00442     vkQueueWaitIdle(m_graphicsQueue);
00443
00444     vkFreeCommandBuffers(m_device, m_commandPool, 1, &commandBuffer);
00445 }
00446
00447 void ven::Device::copyBuffer(const VkBuffer srcBuffer, const VkBuffer dstBuffer, const VkDeviceSize
size) const
00448 {
00449     const VkCommandBuffer commandBuffer = beginSingleTimeCommands();
00450
00451     VkBufferCopy copyRegion{};
00452     copyRegion.srcOffset = 0; // Optional
00453     copyRegion.dstOffset = 0; // Optional
00454     copyRegion.size = size;
00455     vkCmdCopyBuffer(commandBuffer, srcBuffer, dstBuffer, 1, &copyRegion);
00456
00457     endSingleTimeCommands(commandBuffer);
00458 }
00459
00460 void ven::Device::copyBufferToImage(const VkBuffer buffer, const VkImage image, const uint32_t width,
const uint32_t height, const uint32_t layerCount) const
00461 {
00462     const VkCommandBuffer commandBuffer = beginSingleTimeCommands();
00463     const VkBufferImageCopy region{
00464         .bufferOffset = 0,
00465         .bufferRowLength = 0,
00466         .bufferImageHeight = 0,
00467         .imageSubresource = {
00468             .aspectMask = VK_IMAGE_ASPECT_COLOR_BIT,
00469             .mipLevel = 0,
00470             .baseArrayLayer = 0,
00471             .layerCount = layerCount
00472         },
00473         .imageOffset = {0, 0, 0},
00474         .imageExtent = {width, height, 1}
00475     };
00476
00477     vkCmdCopyBufferToImage(commandBuffer, buffer, image, VK_IMAGE_LAYOUT_TRANSFER_DST_OPTIMAL, 1,
&region);
00478     endSingleTimeCommands(commandBuffer);
00479 }
00480
00481 void ven::Device::createImageWithInfo(const VkImageCreateInfo &imageInfo, const VkMemoryPropertyFlags
properties, VkImage &image, VkDeviceMemory &imageMemory) const
00482 {
00483     if (vkCreateImage(m_device, &imageInfo, nullptr, &image) != VK_SUCCESS) {
00484         throw std::runtime_error("failed to create image!");
00485     }
00486
00487     VkMemoryRequirements memRequirements;
00488     vkGetImageMemoryRequirements(m_device, image, &memRequirements);
00489
00490     VkMemoryAllocateInfo allocInfo{};

```

```

00491     allocInfo.sType = VK_STRUCTURE_TYPE_MEMORY_ALLOCATE_INFO;
00492     allocInfo.allocationSize = memRequirements.size;
00493     allocInfo.memoryTypeIndex = findMemoryType(memRequirements.memoryTypeBits, properties);
00494
00495     if (vkAllocateMemory(m_device, &allocInfo, nullptr, &imageMemory) != VK_SUCCESS) {
00496         throw std::runtime_error("failed to allocate image memory!");
00497     }
00498
00499     if (vkBindImageMemory(m_device, image, imageMemory, 0) != VK_SUCCESS) {
00500         throw std::runtime_error("failed to bind image memory!");
00501     }
00502 }
00503
00504 void ven::Device::transitionImageLayout(const VkImage image, const VkFormat format, const
VkImageLayout oldLayout, const VkImageLayout newLayout, const uint32_t mipLevels, const uint32_t
layerCount) const {
00505     // uses an image memory barrier transition image layouts and transfer queue
00506     // family ownership when VK_SHARING_MODE_EXCLUSIVE is used. There is an
00507     // equivalent buffer memory barrier to do this for buffers
00508     const VkCommandBuffer commandBuffer = beginSingleTimeCommands();
00509
00510     VkImageMemoryBarrier barrier{};
00511     barrier.sType = VK_STRUCTURE_TYPE_IMAGE_MEMORY_BARRIER;
00512     barrier.oldLayout = oldLayout;
00513     barrier.newLayout = newLayout;
00514
00515     barrier.srcQueueFamilyIndex = VK_QUEUE_FAMILY_IGNORED;
00516     barrier.dstQueueFamilyIndex = VK_QUEUE_FAMILY_IGNORED;
00517
00518     barrier.image = image;
00519     barrier.subresourceRange.baseMipLevel = 0;
00520     barrier.subresourceRange.levelCount = mipLevels;
00521     barrier.subresourceRange.baseArrayLayer = 0;
00522     barrier.subresourceRange.layerCount = layerCount;
00523
00524     if (newLayout == VK_IMAGE_LAYOUT_DEPTH_STENCIL_ATTACHMENT_OPTIMAL) {
00525         barrier.subresourceRange.aspectMask = VK_IMAGE_ASPECT_DEPTH_BIT;
00526         if (format == VK_FORMAT_D32_SFLOAT_S8_UINT || format == VK_FORMAT_D24_UNORM_S8_UINT) {
00527             barrier.subresourceRange.aspectMask |= VK_IMAGE_ASPECT_STENCIL_BIT;
00528         }
00529     } else {
00530         barrier.subresourceRange.aspectMask = VK_IMAGE_ASPECT_COLOR_BIT;
00531     }
00532
00533     VkPipelineStageFlags sourceStage = 0;
00534     VkPipelineStageFlags destinationStage = 0;
00535
00536     if (oldLayout == VK_IMAGE_LAYOUT_UNDEFINED && newLayout == VK_IMAGE_LAYOUT_TRANSFER_DST_OPTIMAL) {
00537         barrier.srcAccessMask = 0;
00538         barrier.dstAccessMask = VK_ACCESS_TRANSFER_WRITE_BIT;
00539
00540         sourceStage = VK_PIPELINE_STAGE_TOP_OF_PIPE_BIT;
00541         destinationStage = VK_PIPELINE_STAGE_TRANSFER_BIT;
00542     } else if (
00543         oldLayout == VK_IMAGE_LAYOUT_UNDEFINED && newLayout == VK_IMAGE_LAYOUT_TRANSFER_SRC_OPTIMAL) {
00544         barrier.srcAccessMask = 0;
00545         barrier.dstAccessMask = VK_ACCESS_TRANSFER_WRITE_BIT;
00546
00547         sourceStage = VK_PIPELINE_STAGE_TOP_OF_PIPE_BIT;
00548         destinationStage = VK_PIPELINE_STAGE_TRANSFER_BIT;
00549     } else if (
00550         oldLayout == VK_IMAGE_LAYOUT_TRANSFER_DST_OPTIMAL &&
00551         newLayout == VK_IMAGE_LAYOUT_SHADER_READ_ONLY_OPTIMAL) {
00552         barrier.srcAccessMask = VK_ACCESS_TRANSFER_WRITE_BIT;
00553         barrier.dstAccessMask = VK_ACCESS_SHADER_READ_BIT;
00554
00555         sourceStage = VK_PIPELINE_STAGE_TRANSFER_BIT;
00556         destinationStage = VK_PIPELINE_STAGE_FRAGMENT_SHADER_BIT;
00557     } else if (
00558         oldLayout == VK_IMAGE_LAYOUT_UNDEFINED &&
00559         newLayout == VK_IMAGE_LAYOUT_DEPTH_STENCIL_ATTACHMENT_OPTIMAL) {
00560         barrier.srcAccessMask = 0;
00561         barrier.dstAccessMask =
00562             VK_ACCESS_DEPTH_STENCIL_ATTACHMENT_READ_BIT | VK_ACCESS_DEPTH_STENCIL_ATTACHMENT_WRITE_BIT;
00563
00564         sourceStage = VK_PIPELINE_STAGE_TOP_OF_PIPE_BIT;
00565         destinationStage = VK_PIPELINE_STAGE_EARLY_FRAGMENT_TESTS_BIT;
00566     } else {
00567         throw std::invalid_argument("unsupported layout transition!");
00568     }
00569     vkCmdPipelineBarrier(
00570         commandBuffer,
00571         sourceStage,
00572         destinationStage,
00573         0,
00574         0,
00575         nullptr,

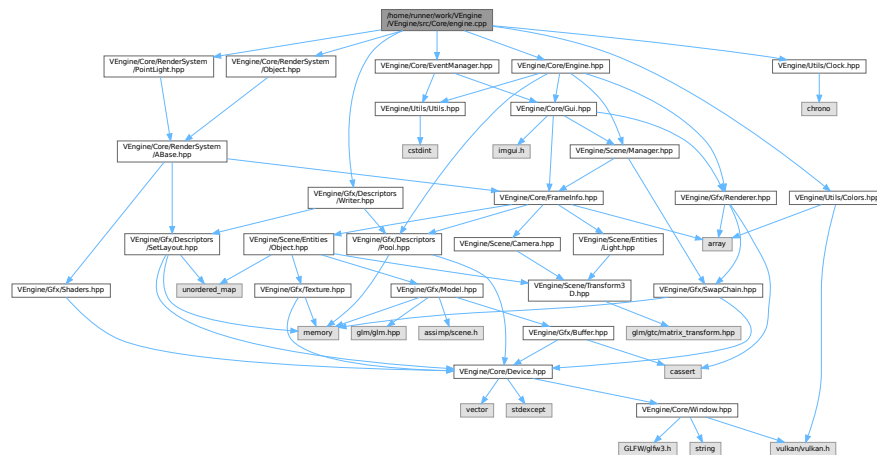
```

```
00576         0,  
00577         nullptr,  
00578         1,  
00579         &barrier);  
00580  
00581     endSingleTimeCommands(commandBuffer);  
00582 }
```

8.66 /home/runner/work/VEngine/VEngine/src/Core/engine.cpp File Reference

```
#include "VEngine/Core/Engine.hpp"
#include "VEngine/Core/EventManager.hpp"
#include "VEngine/Core/RenderSystem/Object.hpp"
#include "VEngine/Core/RenderSystem/PointLight.hpp"
#include "VEngine/Gfx/Descriptors/Writer.hpp"
#include "VEngine/Utils/Colors.hpp"
#include "VEngine/Utils/Clock.hpp"
```

Include dependency graph for engine.cpp:



8.67 engine.cpp

[Go to the documentation of this file.](#)

```
00001 #include "VEngine/Core/Engine.hpp"
00002 #include "VEngine/Core/EventManager.hpp"
00003 #include "VEngine/Core/RenderSystem/Object.hpp"
00004 #include "VEngine/Core/RenderSystem/PointLight.hpp"
00005 #include "VEngine/Gfx/Descriptors/Writer.hpp"
00006 #include "VEngine/Utils/Colors.hpp"
00007 #include "VEngine/Utils/Clock.hpp"
00008
00009 ven::Engine::Engine(const uint32_t width, const uint32_t height, const std::string &title) :
m_state(EDITOR), m_window(width, height, title) {
00010     m_gui.init(m_window.getGLFWWindow(), m_device.getInstance(), &m_device,
m_renderer.getSwapChainRenderPass());
00011     m_globalPool =
DescriptorPool::Builder(m_device).setMaxSets(MAX_FRAMES_IN_FLIGHT).addPoolSize(VK_DESCRIPTOR_TYPE_UNIFORM_BUFFER,
MAX_FRAMES_IN_FLIGHT).build();
00012
00013     m_framePools.resize(MAX_FRAMES_IN_FLIGHT);
00014     const auto framePoolBuilder = DescriptorPool::Builder(m_device)
00015         .setMaxSets(1000)
00016         .addPoolSize(VK_DESCRIPTOR_TYPE_COMBINED_IMAGE_SAMPLER, 1000)
00017         .addPoolSize(VK_DESCRIPTOR_TYPE_UNIFORM_BUFFER, 1000)
```

```

00018         .setPoolFlags(VK_DESCRIPTOR_POOL_CREATE_FREE_DESCRIPTOR_SET_BIT);
00019     for (auto & framePool : m_framePools) {
00020         framePool = framePoolBuilder.build();
00021     }
00022
00023     loadObjects();
00024 }
00025
00026 void ven::Engine::loadObjects()
00027 {
00028     constexpr std::array lightColors{
00029         Colors::RED_4,
00030         Colors::GREEN_4,
00031         Colors::BLUE_4,
00032         Colors::YELLOW_4,
00033         Colors::CYAN_4,
00034         Colors::MAGENTA_4
00035     };
00036     auto& quad = m_sceneManager.createObject();
00037     quad.setName("quad");
00038     quad.setModel(Model::createModelFromFile(m_device, "assets/models/quad.obj"));
00039     quad.transform.translation = {0.F, .5F, 0.F};
00040     quad.transform.scale = {3.F, 1.F, 3.F};
00041
00042     auto& flatVase = m_sceneManager.createObject();
00043     flatVase.setName("flat vase");
00044     flatVase.setModel(Model::createModelFromFile(m_device, "assets/models/flat_vase.obj"));
00045     flatVase.transform.translation = {-0.5F, .5F, 0.F};
00046     flatVase.transform.scale = {3.F, 1.5F, 3.F};
00047
00048     auto& smoothVase = m_sceneManager.createObject();
00049     smoothVase.setName("smooth vase");
00050     smoothVase.setModel(Model::createModelFromFile(m_device, "assets/models/smooth_vase.obj"));
00051     smoothVase.transform.translation = {0.5F, .5F, 0.F};
00052     smoothVase.transform.scale = {3.F, 1.5F, 3.F};
00053
00054     for (std::size_t i = 0; i < lightColors.size(); i++)
00055     {
00056         glm::mat4 rotateLight = rotate(
00057             glm::mat4(1.F),
00058             static_cast<float>(i) * glm::two_pi<float>() / static_cast<float>(lightColors.size()),
00059             {0.F, -1.F, 0.F}
00060         );
00061         auto& pointLight = m_sceneManager.createLight();
00062         pointLight.color = lightColors.at(i);
00063         pointLight.transform.translation = glm::vec3(rotateLight * glm::vec4(-1.F, -1.F, -1.F, 1.F));
00064     }
00065 }
00066
00067 void ven::Engine::mainLoop()
00068 {
00069     Clock clock;
00070     Camera camera{};
00071     EventManager eventManager{};
00072     GlobalUbo ubo{};
00073     VkCommandBuffer_T *commandBuffer = nullptr;
00074     VkDescriptorBufferInfo bufferInfo{};
00075     float frameTime = 0.0F;
00076     unsigned long frameIndex = 0;
00077     std::unique_ptr globalSetLayout(DescriptorSetLayout::Builder(m_device).addBinding(0,
VK_DESCRIPTOR_TYPE_UNIFORM_BUFFER, VK_SHADER_STAGE_ALL_GRAPHICS).build());
00078     std::vector<std::unique_ptr<Buffer>> uboBuffers(MAX_FRAMES_IN_FLIGHT);
00079     std::vector<VkDescriptorSet> globalDescriptorSets(MAX_FRAMES_IN_FLIGHT);
00080     ObjectRenderSystem objectRenderSystem(m_device, m_renderer.getSwapChainRenderPass(),
globalSetLayout->getDescriptorSetLayout());
00081     PointLightRenderSystem pointLightRenderSystem(m_device, m_renderer.getSwapChainRenderPass(),
globalSetLayout->getDescriptorSetLayout());
00082
00083     for (auto& uboBuffer : uboBuffers)
00084     {
00085         uboBuffer = std::make_unique<Buffer>(m_device, sizeof(GlobalUbo), 1,
VK_BUFFER_USAGE_UNIFORM_BUFFER_BIT, VK_MEMORY_PROPERTY_HOST_VISIBLE_BIT);
00086         uboBuffer->map();
00087     }
00088     for (std::size_t i = 0; i < globalDescriptorSets.size(); i++) {
00089         bufferInfo = uboBuffers[i]->descriptorInfo();
00090         DescriptorWriter(*globalSetLayout, *m_globalPool).writeBuffer(0,
&bufferInfo).build(globalDescriptorSets[i]);
00091     }
00092
00093     while (m_state != EXIT)
00094     {
00095         clock.update();
00096         frameTime = clock.getDeltaTime();
00097         eventManager.handleEvents(m_window.getGLFWWindow(), &m_state, camera, m_gui, frameTime);
00098         commandBuffer = m_renderer.beginFrame();
00099     }

```



```

00100         camera.setViewXYZ(camera.transform.translation, camera.transform.rotation);
00101         camera.setPerspectiveProjection(m_renderer.getAspectRatio());
00102
00103         if (commandBuffer != nullptr) {
00104             frameIndex = m_renderer.getFrameIndex();
00105             m_framePools[frameIndex]->resetPool();
00106             FrameInfo frameInfo{
00107                 .frameIndex=frameIndex,
00108                 .frameTime=frameTime,
00109                 .commandBuffer=commandBuffer,
00110                 .camera=camera,
00111                 .globalDescriptorSet=globalDescriptorSets[frameIndex],
00112                 .frameDescriptorPool=*m_framePools[frameIndex],
00113                 .objects=m_sceneManager.getObjects(),
00114                 .lights=m_sceneManager.getLights()
00115             };
00116             ubo.projection=camera.getProjection();
00117             ubo.view=camera.getView();
00118             ubo.inverseView=camera.getInverseView();
00119             m_sceneManager.updateBuffer(ubo, frameIndex, frameTime);
00120             uboBuffers.at(frameIndex)->writeToBuffer(&ubo);
00121             uboBuffers.at(frameIndex)->flush();
00122             m_renderer.beginSwapChainRenderPass(frameInfo.commandBuffer);
00123             objectRenderSystem.render(frameInfo);
00124             pointLightRenderSystem.render(frameInfo);
00125
00126             if (m_gui.getState() != HIDDEN) {
00127                 m_gui.render(
00128                     &m_renderer,
00129                     m_sceneManager,
00130                     camera,
00131                     m_device.getPhysicalDevice(),
00132                     ubo,
00133                     { .deltaTimeMS=clock.getDeltaTimeMS(), .fps=clock.getFPS() }
00134                 );
00135             }
00136
00137             m_renderer.endSwapChainRenderPass(commandBuffer);
00138             m_renderer.endFrame();
00139             commandBuffer = nullptr;
00140         }
00141         if (m_sceneManager.getDestroyState()) {
00142             vkDeviceWaitIdle(m_device.device());
00143             m_sceneManager.destroyEntity(m_gui.getObjectsToRemove(), m_gui.getLightsToRemove());
00144         }
00145     }
00146     vkDeviceWaitIdle(m_device.device());
00147 }
00148
00149 void ven::Engine::cleanup()
00150 {
00151     Gui::cleanup();
00152 }

```

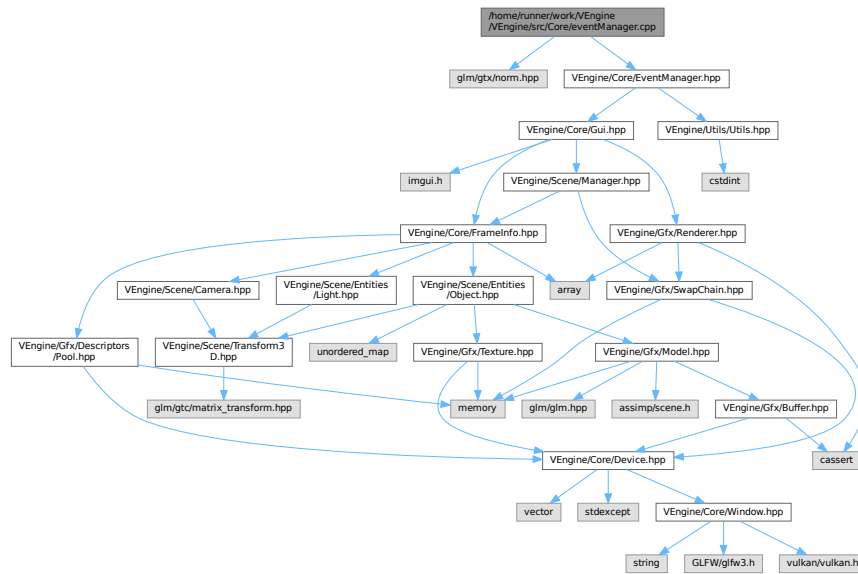
8.68 /home/runner/work/VEngine/VEngine/src/Core/eventManager.cpp File Reference

```

#include <glm/gtx/norm.hpp>
#include "VEngine/Core/EventManager.hpp"

```

Include dependency graph for eventManager.cpp:



Macros

- `#define GLM_ENABLE_EXPERIMENTAL`

8.68.1 Macro Definition Documentation

8.68.1.1 GLM_ENABLE_EXPERIMENTAL

```
#define GLM_ENABLE_EXPERIMENTAL
```

Definition at line 1 of file [eventManager.cpp](#).

8.69 eventManager.cpp

[Go to the documentation of this file.](#)

```
00001 #define GLM_ENABLE_EXPERIMENTAL
00002 #include <glm/gtx/norm.hpp>
00003
00004 #include "VEngine/Core/EventManager.hpp"
00005
00006 bool ven::EventManager::isKeyJustPressed(GLFWwindow* window, const long unsigned int key,
std::array<bool, GLFW_KEY_LAST>& keyStates)
00007 {
00008     const bool isPressed = glfwGetKey(window, static_cast<int>(key)) == GLFW_PRESS;
00009     const bool wasPressed = keyStates.at(key);
00010
00011     keyStates.at(key) = isPressed;
00012
00013     return isPressed && !wasPressed;
00014 }
00015
00016 template<typename Iterator>
00017 void ven::EventManager::processKeyActions(GLFWwindow* window, Iterator begin, Iterator end)
00018 {
00019     for (auto it = begin; it != end; ++it) {
```

```

00020         if (glfwGetKey(window, it->key) == GLFW_PRESS) {
00021             *it->dir += it->value;
00022         }
00023     }
00024 }
00025
00026 void ven::EventManager::moveCamera(GLFWwindow* window, Camera& camera, const float dt)
00027 {
00028     glm::vec3 rotate{0};
00029     glm::vec3 moveDir{0.F};
00030     static constexpr glm::vec3 upDir{0.F, -1.F, 0.F};
00031     const float yaw = camera.transform.rotation.y;
00032     const glm::vec3 forwardDir{std::sin(yaw), 0.F, std::cos(yaw)};
00033     const glm::vec3 rightDir{forwardDir.z, 0.F, -forwardDir.x};
00034     const std::array<KeyAction, 10> moveActions = {{
00035         {.key=DEFAULT_KEY_MAPPINGS.lookLeft, .dir=&rotate, .value={0.F, -1.F, 0.F}},
00036         {.key=DEFAULT_KEY_MAPPINGS.lookRight, .dir=&rotate, .value={0.F, 1.F, 0.F}},
00037         {.key=DEFAULT_KEY_MAPPINGS.lookUp, .dir=&rotate, .value={1.F, 0.F, 0.F}},
00038         {.key=DEFAULT_KEY_MAPPINGS.lookDown, .dir=&rotate, .value={-1.F, 0.F, 0.F}},
00039         {.key=DEFAULT_KEY_MAPPINGS.moveForward, .dir=&moveDir, .value=forwardDir},
00040         {.key=DEFAULT_KEY_MAPPINGS.moveBackward, .dir=&moveDir, .value=-forwardDir},
00041         {.key=DEFAULT_KEY_MAPPINGS.moveRight, .dir=&moveDir, .value=rightDir},
00042         {.key=DEFAULT_KEY_MAPPINGS.moveLeft, .dir=&moveDir, .value=-rightDir},
00043         {.key=DEFAULT_KEY_MAPPINGS.moveUp, .dir=&moveDir, .value=upDir},
00044         {.key=DEFAULT_KEY_MAPPINGS.moveDown, .dir=&moveDir, .value=-upDir}
00045     }};
00046
00047     processKeyActions(window, moveActions.begin(), moveActions.end());
00048
00049     if (const float lengthRotate = length2(rotate); lengthRotate > EPSILON) {
00050         camera.transform.rotation += camera.getLookSpeed() * dt * rotate / std::sqrt(lengthRotate);
00051     }
00052     if (const float lengthMove = length2(moveDir); lengthMove > EPSILON) {
00053         camera.transform.translation += camera.getMoveSpeed() * dt * moveDir / std::sqrt(lengthMove);
00054     }
00055
00056     camera.transform.rotation.x = glm::clamp(camera.transform.rotation.x, -1.5F, 1.5F);
00057     camera.transform.rotation.y = glm::mod(camera.transform.rotation.y, glm::two_pi<float>());
00058 }
00059
00060 void ven::EventManager::handleEvents(GLFWwindow *window, ENGINE_STATE *engineState, Camera& camera,
Gui& gui, const float dt) const
00061 {
00062     glfwPollEvents();
00063     if (glfwWindowShouldClose(window) == GLFW_TRUE) {
00064         updateEngineState(engineState, EXIT);
00065     }
00066     if (isKeyJustPressed(window, DEFAULT_KEY_MAPPINGS.toggleGui, m_keyState)) {
00067         if (gui.getState() != HIDDEN) {
00068             gui.setState(HIDDEN);
00069         } else {
00070             if (*engineState == EDITOR) {
00071                 gui.setState(SHOW_EDITOR);
00072             } else {
00073                 gui.setState(SHOW_PLAYER);
00074             }
00075         }
00076     }
00077     moveCamera(window, camera, dt);
00078 }

```

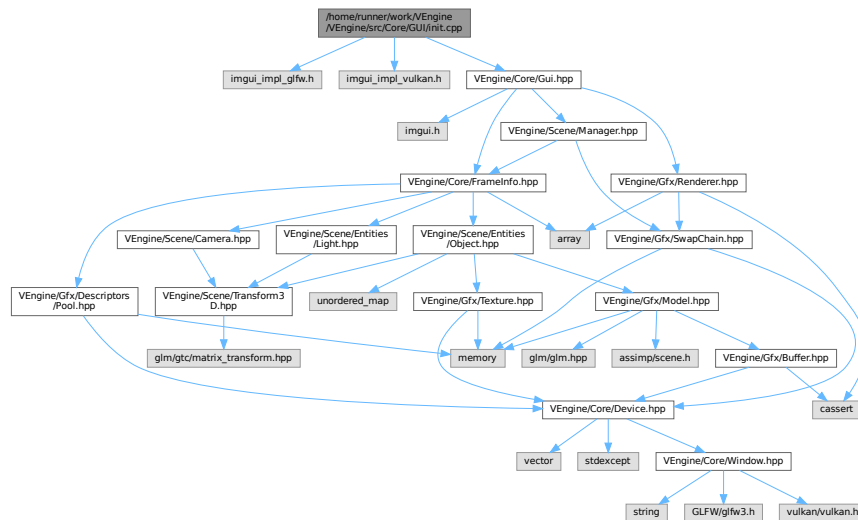
8.70 /home/runner/work/VEngine/VEngine/src/Core/GUI/init.cpp File Reference

```

#include <imgui_impl_glfw.h>
#include <imgui_impl_vulkan.h>
#include "VEngine/Core/Gui.hpp"

```

Include dependency graph for init.cpp:



8.71 init.cpp

[Go to the documentation of this file.](#)

```

00001 #include <ImGui_Impl_Glfw.h>
00002 #include <ImGui_Impl_Vulkan.h>
00003
00004 #include "VEngine/Core/GUI.hpp"
00005
00006 void ven::Gui::init(GLFWwindow* window, const VkInstance instance, const Device* device, const
VkRenderPass renderPass)
00007 {
00008     VkDescriptorPool pool = nullptr;
00009     ImGui_ImplVulkan_InitInfo init_info{};
00010     ImGui::CreateContext();
00011     m_io = &ImGui::GetIO();
00012     m_io->IniFilename = nullptr;
00013
00014     constexpr std::array<VkDescriptorPoolSize, 11> pool_sizes = {{
00015         { .type=VK_DESCRIPTOR_TYPE_SAMPLER, .descriptorCount=DESCRIPTOR_COUNT },
00016         { .type=VK_DESCRIPTOR_TYPE_COMBINED_IMAGE_SAMPLER, .descriptorCount=DESCRIPTOR_COUNT },
00017         { .type=VK_DESCRIPTOR_TYPE_SAMPLED_IMAGE, .descriptorCount=DESCRIPTOR_COUNT },
00018         { .type=VK_DESCRIPTOR_TYPE_STORAGE_IMAGE, .descriptorCount=DESCRIPTOR_COUNT },
00019         { .type=VK_DESCRIPTOR_TYPE_UNIFORM_TEXEL_BUFFER, .descriptorCount=DESCRIPTOR_COUNT },
00020         { .type=VK_DESCRIPTOR_TYPE_STORAGE_TEXEL_BUFFER, .descriptorCount=DESCRIPTOR_COUNT },
00021         { .type=VK_DESCRIPTOR_TYPE_UNIFORM_BUFFER, .descriptorCount=DESCRIPTOR_COUNT },
00022         { .type=VK_DESCRIPTOR_TYPE_STORAGE_BUFFER, .descriptorCount=DESCRIPTOR_COUNT },
00023         { .type=VK_DESCRIPTOR_TYPE_UNIFORM_BUFFER_DYNAMIC, .descriptorCount=DESCRIPTOR_COUNT },
00024         { .type=VK_DESCRIPTOR_TYPE_STORAGE_BUFFER_DYNAMIC, .descriptorCount=DESCRIPTOR_COUNT },
00025         { .type=VK_DESCRIPTOR_TYPE_INPUT_ATTACHMENT, .descriptorCount=DESCRIPTOR_COUNT }
00026     }};
00027     const VkDescriptorPoolCreateInfo pool_info = {
00028         VK_STRUCTURE_TYPE_DESCRIPTOR_POOL_CREATE_INFO,
00029         nullptr,
00030         VK_DESCRIPTOR_POOL_CREATE_FREE_DESCRIPTOR_SET_BIT,
00031         DESCRIPTOR_COUNT,
00032         std::size(pool_sizes),
00033         pool_sizes.data()
00034     };
00035
00036     if (vkCreateDescriptorPool(device->device(), &pool_info, nullptr, &pool) != VK_SUCCESS) {
00037         throw std::runtime_error("Failed to create ImGui descriptor pool");
00038     }
00039
00040     init_info.Instance = instance;
00041     init_info.PhysicalDevice = device->getPhysicalDevice();
00042     init_info.Device = device->device();
00043     init_info.Queue = device->graphicsQueue();
00044     init_info.DescriptorPool = pool;

```

```

00045     init_info.MinImageCount = 3;
00046     init_info.ImageCount = 3;
00047     init_info.MSAASamples = VK_SAMPLE_COUNT_1_BIT;
00048
00049     ImGui_ImplGlfw_InitForVulkan(window, true);
00050     ImGui_ImplVulkan_Init(&init_info, renderPass);
00051     initStyle();
00052 }
00053
00054 void ven::Gui::initStyle()
00055 {
00056     ImGuiStyle& style = ImGui::GetStyle();
00057     style.Alpha = 1.0;
00058     style.WindowRounding = 3;
00059     style.GrabRounding = 1;
00060     style.GrabMinSize = 20;
00061     style.FrameRounding = 3;
00062
00063     style.Colors[ImGuiCol_Text] = ImVec4(0.00F, 1.00F, 1.00F, 1.00F);
00064     style.Colors[ImGuiCol_TextDisabled] = ImVec4(0.00F, 0.40F, 0.41F, 1.00F);
00065     style.Colors[ImGuiCol_WindowBg] = ImVec4(0.1F, 0.1F, 0.1F, 0.70F);
00066     style.Colors[ImGuiCol_Border] = ImVec4(0.00F, 1.00F, 1.00F, 0.35F);
00067     style.Colors[ImGuiCol_BorderShadow] = ImVec4(0.00F, 0.00F, 0.00F, 0.00F);
00068     style.Colors[ImGuiCol_FrameBg] = ImVec4(0.44F, 0.80F, 0.80F, 0.18F);
00069     style.Colors[ImGuiCol_FrameBgHovered] = ImVec4(0.44F, 0.80F, 0.80F, 0.27F);
00070     style.Colors[ImGuiCol_FrameBgActive] = ImVec4(0.44F, 0.81F, 0.86F, 0.66F);
00071     style.Colors[ImGuiCol_TitleBg] = ImVec4(0.14F, 0.18F, 0.21F, 0.73F);
00072     style.Colors[ImGuiCol_TitleBgCollapsed] = ImVec4(0.00F, 0.00F, 0.00F, 0.54F);
00073     style.Colors[ImGuiCol_TitleBgActive] = ImVec4(0.00F, 1.00F, 1.00F, 0.27F);
00074     style.Colors[ImGuiCol_MenuBarBg] = ImVec4(0.00F, 0.00F, 0.00F, 0.20F);
00075     style.Colors[ImGuiCol_ScrollbarBg] = ImVec4(0.22F, 0.29F, 0.30F, 0.71F);
00076     style.Colors[ImGuiCol_ScrollbarGrab] = ImVec4(0.00F, 1.00F, 1.00F, 0.44F);
00077     style.Colors[ImGuiCol_ScrollbarGrabHovered] = ImVec4(0.00F, 1.00F, 1.00F, 0.74F);
00078     style.Colors[ImGuiCol_ScrollbarGrabActive] = ImVec4(0.00F, 1.00F, 1.00F, 1.00F);
00079     style.Colors[ImGuiCol_CheckMark] = ImVec4(0.00F, 1.00F, 1.00F, 0.68F);
00080     style.Colors[ImGuiCol_SliderGrab] = ImVec4(0.00F, 1.00F, 1.00F, 0.36F);
00081     style.Colors[ImGuiCol_SliderGrabActive] = ImVec4(0.00F, 1.00F, 1.00F, 0.76F);
00082     style.Colors[ImGuiCol_Button] = ImVec4(0.00F, 0.65F, 0.65F, 0.46F);
00083     style.Colors[ImGuiCol_ButtonHovered] = ImVec4(0.01F, 1.00F, 1.00F, 0.43F);
00084     style.Colors[ImGuiCol_ButtonActive] = ImVec4(0.00F, 1.00F, 1.00F, 0.62F);
00085     style.Colors[ImGuiCol_Header] = ImVec4(0.00F, 1.00F, 1.00F, 0.33F);
00086     style.Colors[ImGuiCol_HeaderHovered] = ImVec4(0.00F, 1.00F, 1.00F, 0.42F);
00087     style.Colors[ImGuiCol_HeaderActive] = ImVec4(0.00F, 1.00F, 1.00F, 0.54F);
00088     style.Colors[ImGuiCol_ResizeGrip] = ImVec4(0.00F, 1.00F, 1.00F, 0.54F);
00089     style.Colors[ImGuiCol_ResizeGripHovered] = ImVec4(0.00F, 1.00F, 1.00F, 0.74F);
00090     style.Colors[ImGuiCol_ResizeGripActive] = ImVec4(0.00F, 1.00F, 1.00F, 1.00F);
00091     style.Colors[ImGuiCol_PlotLines] = ImVec4(0.00F, 1.00F, 1.00F, 1.00F);
00092     style.Colors[ImGuiCol_PlotLinesHovered] = ImVec4(0.00F, 1.00F, 1.00F, 1.00F);
00093     style.Colors[ImGuiCol_PlotHistogram] = ImVec4(0.00F, 1.00F, 1.00F, 1.00F);
00094     style.Colors[ImGuiCol_PlotHistogramHovered] = ImVec4(0.00F, 1.00F, 1.00F, 1.00F);
00095     style.Colors[ImGuiCol_TextSelectedBg] = ImVec4(0.00F, 1.00F, 1.00F, 0.22F);
00096 }

```

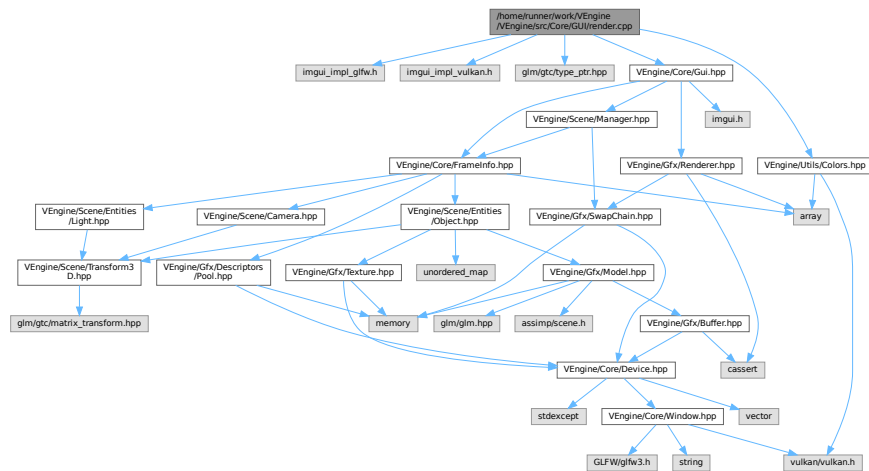
8.72 /home/runner/work/VEngine/VEngine/src/Core/GUI/render.cpp File Reference

```

#include <imgui_impl_glfw.h>
#include <imgui_impl_vulkan.h>
#include <glm/gtc/type_ptr.hpp>
#include "VEngine/Core/Gui.hpp"
#include "VEngine/Utils/Colors.hpp"

```

Include dependency graph for render.cpp:



8.73 render.cpp

[Go to the documentation of this file.](#)

```

00001 #include <imgui_impl_glfw.h>
00002 #include <imgui_impl_vulkan.h>
00003
00004 #include <glm/gtc/type_ptr.hpp>
00005
00006 #include "VEngine/Core/GUI.hpp"
00007 #include "VEngine/Utils/Colors.hpp"
00008
00009 void ven::Gui::cleanup()
00010 {
00011     ImGui_ImplVulkan_Shutdown();
00012     ImGui_ImplGlfw_Shutdown();
00013     ImGui::DestroyContext();
00014 }
00015
00016 void ven::Gui::render(Renderer* renderer, SceneManager& sceneManager, Camera& camera, const
VkPhysicalDevice physicalDevice, GlobalUbo& ubo, const ClockData& clockData)
00017 {
00018     VkPhysicalDeviceProperties deviceProperties;
00019     vkGetPhysicalDeviceProperties(physicalDevice, &deviceProperties);
00020     ImGui_ImplVulkan_NewFrame();
00021     ImGui_ImplGlfw_NewFrame();
00022     ImGui::NewFrame();
00023     renderFrameWindow(clockData);
00024
00025     rendererSection(renderer, ubo);
00026     cameraSection(camera);
00027     lightsSection(sceneManager);
00028     objectsSection(sceneManager);
00029     inputsSection(*m_io);
00030     devicePropertiesSection(deviceProperties);
00031
00032     ImGui::End();
00033     ImGui::Render();
00034     ImGui_ImplVulkan_RenderDrawData(ImGui::GetDrawData(), renderer->getCurrentCommandBuffer());
00035 }
00036
00037 void ven::Gui::renderFrameWindow(const ClockData& clockData)
00038 {
00039     ImGui::SetNextWindowPos(ImVec2(0.0F, 0.0F), ImGuiCond_Always, ImVec2(0.0F, 0.0F));
00040     ImGui::Begin("Application Info", nullptr, ImGuiWindowFlags_NoDecoration | ImGuiWindowFlags_NoMove
| ImGuiWindowFlags_NoResize | ImGuiWindowFlags_NoSavedSettings | ImGuiWindowFlags_NoFocusOnAppearing |
ImGuiWindowFlags_NoNav);
00041     ImGui::Text("FPS: %.1f", clockData.fps);
00042     ImGui::Text("Frame time: %.3fms", clockData.deltaTimeMS);
00043     ImGui::End();
00044 }
00045

```

```

00046 void ven::Gui::rendererSection(Renderer *renderer, GlobalUbo& ubo)
00047 {
00048     ImGui::SetNextWindowPos(ImVec2(0.0F, 45.0F), ImGuiCond_Always, ImVec2(0.0F, 0.0F));
00049     ImGui::Begin("Editor tools");
00050     if (ImGui::CollapsingHeader("Renderer")) {
00051         ImGui::Text("Aspect Ratio: %.2f", renderer->getAspectRatio());
00052
00053         if (ImGui::BeginTable("ClearColorTable", 2)) {
00054             ImGui::TableNextColumn();
00055             std::array<float, 4> clearColor = renderer->getClearColor();
00056
00057             if (ImGui::ColorEdit4("Clear Color", clearColor.data())) {
00058                 const VkClearColorValue clearColorValue = {{clearColor[0], clearColor[1],
clearColor[2], clearColor[3]}};
00059                 renderer->setClearColorValue(clearColorValue);
00060             }
00061
00062             ImGui::TableNextColumn();
00063             static int item_current = 0;
00064
00065             if (ImGui::Combo("Color Presets##clearColor",
00066                             &item_current,
00067                             [](void*, const int idx, const char** out_text) -> bool {
00068                                 if (idx < 0 || idx >=
static_cast<int>(std::size(Colors::COLOR_PRESETS_VK))) { return false; }
00069                                 *out_text = Colors::COLOR_PRESETS_VK.at(static_cast<unsigned
long>(idx)).first;
00070                                 return true;
00071                             },
00072                             nullptr,
00073                             std::size(Colors::COLOR_PRESETS_VK))) {
00074                 renderer->setClearColorValue(Colors::COLOR_PRESETS_VK.at(static_cast<unsigned
long>(item_current)).second);
00075             }
00076
00077             ImGui::TableNextColumn();
00078             ImGui::ColorEdit4("Ambient Light Color", glm::value_ptr(ubo.ambientLightColor));
00079             ImGui::TableNextColumn();
00080             if (ImGui::Combo("Color Presets##ambientColor",
00081                             &item_current,
00082                             [](void*, const int idx, const char** out_text) -> bool {
00083                                 if (idx < 0 || idx >=
static_cast<int>(std::size(Colors::COLOR_PRESETS_4))) { return false; }
00084                                 *out_text = Colors::COLOR_PRESETS_4.at(static_cast<unsigned
long>(idx)).first;
00085                                 return true;
00086                             },
00087                             nullptr,
00088                             std::size(Colors::COLOR_PRESETS_4))) {
00089                 ubo.ambientLightColor = Colors::COLOR_PRESETS_4.at(static_cast<unsigned
long>(item_current)).second;
00090             }
00091
00092             ImGui::TableNextColumn();
00093             ImGui::SliderFloat(("Intensity##" + std::to_string(0)).c_str(), &ubo.ambientLightColor.a,
0.0F, 1.0F);
00094             ImGui::TableNextColumn();
00095             if (ImGui::Button("Reset##ambientIntensity")) { ubo.ambientLightColor.a =
DEFAULT_AMBIENT_LIGHT_INTENSITY; }
00096
00097             ImGui::EndTable();
00098         }
00099
00100         static bool fullscreen = false;
00101         if (ImGui::Checkbox("Fullscreen", &fullscreen)) {
00102             renderer->getWindow().setFullscreen(fullscreen, renderer->getWindow().getExtent().width,
renderer->getWindow().getExtent().height);
00103         }
00104     }
00105 }
00106
00107 void ven::Gui::cameraSection(Camera &camera)
00108 {
00109     if (ImGui::CollapsingHeader("Camera")) {
00110         float fov = camera.getFov();
00111         float near = camera.getNear();
00112         float far = camera.getFar();
00113         if (ImGui::BeginTable("CameraTable", 2)) {
00114             ImGui::TableNextColumn();
00115             ImGui::DragFloat3("Position", glm::value_ptr(camera.transform.translation), 0.1F);
00116             ImGui::TableNextColumn();
00117             if (ImGui::Button("Reset##position")) { camera.transform.translation = DEFAULT_POSITION; }
00118
00119             ImGui::TableNextColumn();
00120             ImGui::DragFloat3("Rotation", glm::value_ptr(camera.transform.rotation), 0.1F);
00121             ImGui::TableNextColumn();
00122             if (ImGui::Button("Reset##rotation")) { camera.transform.rotation = DEFAULT_ROTATION; }

```

```

00123
00124         ImGui::TableNextColumn();
00125         if (ImGui::SliderFloat("FOV", &fov, glm::radians(0.1F), glm::radians(180.0F))) {
camera.setFov(fov); }
00126         ImGui::TableNextColumn();
00127         if (ImGui::Button("Reset##fov")) { camera.setFov(DEFAULT_FOV); }
00128
00129         ImGui::TableNextColumn();
00130         if (ImGui::SliderFloat("Near", &near, 0.001F, 10.0F)) { camera.setNear(near); }
00131         ImGui::TableNextColumn();
00132         if (ImGui::Button("Reset##near")) { camera.setNear(DEFAULT_NEAR); }
00133
00134         ImGui::TableNextColumn();
00135         if (ImGui::SliderFloat("Far", &far, 1.F, 1000.0F)) { camera.setFar(far); }
00136         ImGui::TableNextColumn();
00137         if (ImGui::Button("Reset##far")) { camera.setFar(DEFAULT_FAR); }
00138
00139         ImGui::TableNextColumn();
00140         float moveSpeed = camera.getMoveSpeed();
00141         if (ImGui::SliderFloat("Move speed", &moveSpeed, 0.1F, 10.0F)) {
camera.setMoveSpeed(moveSpeed); }
00142         ImGui::TableNextColumn();
00143         if (ImGui::Button("Reset##moveSpeed")) { camera.setMoveSpeed(DEFAULT_MOVE_SPEED); }
00144
00145         ImGui::TableNextColumn();
00146         float lookSpeed = camera.getLookSpeed();
00147         if (ImGui::SliderFloat("Look speed", &lookSpeed, 0.1F, 10.0F)) {
camera.setLookSpeed(lookSpeed); }
00148         ImGui::TableNextColumn();
00149         if (ImGui::Button("Reset##lookSpeed")) { camera.setLookSpeed(DEFAULT_LOOK_SPEED); }
00150
00151         ImGui::EndTable();
00152     }
00153 }
00154 }
00155
00156 void ven::Gui::objectsSection(SceneManager& sceneManager)
00157 {
00158     if (ImGui::CollapsingHeader("Objects")) {
00159         bool open = false;
00160         for (Object::Map& objects = sceneManager.getObjects(); auto& [id, object] : objects) {
00161             ImGui::PushStyleColor(ImGuiCol_Text, { Colors::GRAY_4.r, Colors::GRAY_4.g,
Colors::GRAY_4.b, 1.0F });
00162             open = ImGui::TreeNode(std::string(object.getName() + " [" +
std::to_string(object.getId()) + "]").c_str());
00163             ImGui::PopStyleColor(1);
00164             if (open) {
00165                 if (ImGui::Button(("Delete##" + object.getName()).c_str())) {
00166                     m_objectsToRemove.push_back(id);
00167                     sceneManager.setDestroyState(true);
00168                 }
00169                 ImGui::SameLine();
00170                 if (ImGui::Button(("Duplicate##" + object.getName()).c_str())) {
00171                     sceneManager.duplicateObject(id);
00172                 }
00173                 ImGui::Text("Address: %p", static_cast<void*>(&object));
00174                 ImGui::DragFloat3(("Position##" + object.getName()).c_str(),
glm::value_ptr(object.transform.translation), 0.1F);
00175                 ImGui::DragFloat3(("Rotation##" + object.getName()).c_str(),
glm::value_ptr(object.transform.rotation), 0.1F);
00176                 ImGui::DragFloat3(("Scale##" + object.getName()).c_str(),
glm::value_ptr(object.transform.scale), 0.1F);
00177                 ImGui::TreePop();
00178             }
00179         }
00180     }
00181 }
00182
00183 void ven::Gui::lightsSection(SceneManager& sceneManager)
00184 {
00185
00186     if (ImGui::CollapsingHeader("Lights")) {
00187         bool open = false;
00188         float tempIntensity = m_intensity;
00189         float tempShininess = m_shininess;
00190         Light::Map& lights = sceneManager.getLights();
00191
00192         if (ImGui::BeginTable("LightTable", 2)) {
00193             ImGui::TableNextColumn();
00194             if (ImGui::SliderFloat("Global Intensity", &tempIntensity, 0.0F, 5.F)) {
00195                 m_intensity = tempIntensity;
00196                 for (auto& [fst, snd] : lights) {
00197                     snd.color.a = m_intensity;
00198                 }
00199             }
00200             ImGui::TableNextColumn();
00201             if (ImGui::Button("Reset")) {

```



```

00202         m_intensity = DEFAULT_LIGHT_INTENSITY;
00203         tempIntensity = m_intensity;
00204         for (auto&[fst, snd] : lights) {
00205             snd.color.a = m_intensity;
00206         }
00207     }
00208
00209     ImGui::TableNextColumn();
00210     if (ImGui::SliderFloat("Global Shininess", &tempShininess, 0.0F, 512.F)) {
00211         m_shininess = tempShininess;
00212         for (auto&[fst, snd] : lights) {
00213             snd.setShininess(m_shininess);
00214         }
00215     }
00216
00217     ImGui::TableNextColumn();
00218     if (ImGui::Button("Reset")) {
00219         m_shininess = DEFAULT_SHININESS;
00220         tempShininess = m_shininess;
00221         for (auto&[fst, snd] : lights) {
00222             snd.setShininess(m_shininess);
00223         }
00224     }
00225
00226     ImGui::EndTable();
00227 }
00228
00229 for (auto& [id, light] : lights) {
00230     ImGui::PushStyleColor(ImGuiCol_Text, {light.color.r, light.color.g, light.color.b, 1.0F});
00231     open = ImGui::TreeNode(std::string(light.getName() + " [" + std::to_string(light.getId())
+ "]" ).c_str());
00232     ImGui::PopStyleColor(1);
00233     if (open) {
00234         if (ImGui::Button(("Delete##" + light.getName()).c_str())) {
00235             m_lightsToRemove.push_back(id);
00236             sceneManager.setDestroyState(true);
00237         }
00238         ImGui::SameLine();
00239         if (ImGui::Button(("Duplicate##" + light.getName()).c_str())) {
00240             sceneManager.duplicateLight(id);
00241         }
00242         ImGui::Text("Address: %p", static_cast<void*>(&light));
00243         ImGui::DragFloat3(("Position##" + std::to_string(light.getId()).c_str(),
glm::value_ptr(light.transform.translation), 0.1F);
00244         ImGui::DragFloat3(("Rotation##" + std::to_string(light.getId()).c_str(),
glm::value_ptr(light.transform.rotation), 0.1F);
00245         ImGui::DragFloat3(("Scale##" + std::to_string(light.getId()).c_str(),
glm::value_ptr(light.transform.scale), 0.1F);
00246         if (ImGui::BeginTable("ColorTable", 2)) {
00247             ImGui::TableNextColumn();
00248             ImGui::ColorEdit4(("Color##" + std::to_string(light.getId()).c_str(),
glm::value_ptr(light.color));
00249             ImGui::TableNextColumn();
00250             static int item_current = 0;
00251             if (ImGui::Combo("Color Presets",
&item_current,
[])(void*, const int idx, const char** out_text) -> bool {
00252                 if (idx < 0 || idx >=
static_cast<int>(std::size(Colors::COLOR_PRESETS_3))) { return false; }
00253                 *out_text = Colors::COLOR_PRESETS_3.at(static_cast<unsigned
long>(idx)).first;
00254                 return true;
00255             },
nullptr,
std::size(Colors::COLOR_PRESETS_3))) {
00256                 light.color = {Colors::COLOR_PRESETS_3.at(static_cast<unsigned
long>(item_current)).second, light.color.a};
00257             }
00258             ImGui::EndTable();
00259
00260             ImGui::SliderFloat(("Intensity##" + std::to_string(light.getId()).c_str(),
&light.color.a, 0.0F, 5.F);
00261             ImGui::SameLine();
00262             if (ImGui::Button(("Reset##" + std::to_string(light.getId()).c_str())) {
light.color.a = DEFAULT_LIGHT_INTENSITY; }
00263             float shininess = light.getShininess();
00264             if (ImGui::SliderFloat("Shininess", &shininess, 0.0F, 512.F)) {
light.setShininess(shininess);
00265             }
00266             ImGui::SameLine();
00267             if (ImGui::Button("Reset##shininess")) { light.setShininess(DEFAULT_SHININESS); }
00268         }
00269         ImGui::TreePop();
00270     }
00271 }
00272 }
00273 }
00274 }
00275 }
00276 }
00277 }
00278 }

```

```

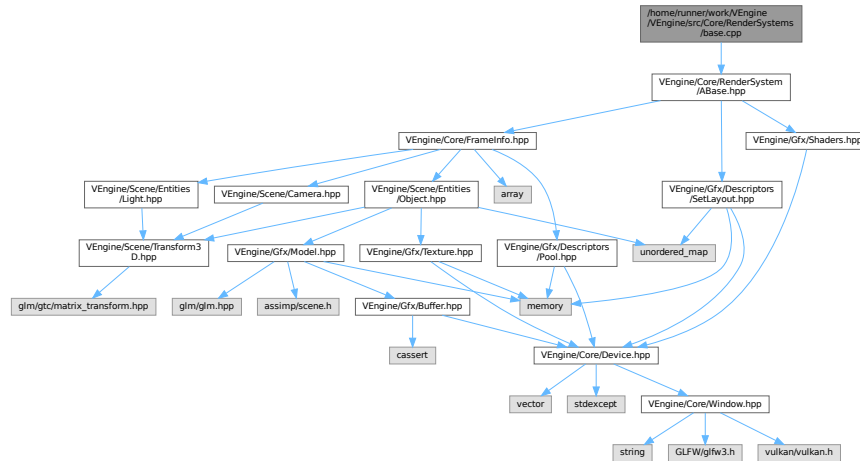
00279
00280 void ven::Gui::inputsSection(const ImGuiIO& io)
00281 {
00282     if (ImGui::CollapsingHeader("Input")) {
00283         ImGui::IsMousePosValid() ? ImGui::Text("Mouse pos: (%g, %g)", io.MousePos.x, io.MousePos.y) :
00284         ImGui::Text("Mouse pos: <INVALID>");
00285         ImGui::Text("Mouse delta: (%g, %g)", io.MouseDelta.x, io.MouseDelta.y);
00286         ImGui::Text("Mouse down:");
00287         for (int i = 0; i < static_cast<int>(std::size(io.MouseDown)); i++) {
00288             if (ImGui::IsMouseDown(i)) {
00289                 ImGui::SameLine();
00290                 ImGui::Text("b%d (%.02f secs)", i, io.MouseDownDuration[i]);
00291             }
00292         }
00293         ImGui::Text("Mouse wheel: %.1f", io.MouseWheel);
00294         ImGui::Text("Keys down:");
00295         for (auto key = static_cast<ImGuiKey>(0); key < ImGuiKey_NamedKey_END; key =
00296         static_cast<ImGuiKey>(key + 1)) {
00297             if (funcs::IsLegacyNativeDupe(key) || !ImGui::IsKeyDown(key)) { continue; }
00298             ImGui::SameLine();
00299             ImGui::Text((key < ImGuiKey_NamedKey_BEGIN) ? "\"%s\" : \"%s\" %d",
00300             ImGui::GetKeyName(key), key);
00301         }
00302     }
00303 }
00304
00305 void ven::Gui::devicePropertiesSection(VkPhysicalDeviceProperties deviceProperties)
00306 {
00307     if (ImGui::CollapsingHeader("Device Properties")) {
00308         if (ImGui::BeginTable("DevicePropertiesTable", 2)) {
00309             ImGui::TableNextColumn(); ImGui::Text("Device Name: %s", deviceProperties.deviceName);
00310             ImGui::TableNextColumn(); ImGui::Text("API Version: %d.%d.%d",
00311             VK_VERSION_MAJOR(deviceProperties.apiVersion), VK_VERSION_MINOR(deviceProperties.apiVersion),
00312             VK_VERSION_PATCH(deviceProperties.apiVersion));
00313             ImGui::TableNextColumn(); ImGui::Text("Driver Version: %d.%d.%d",
00314             VK_VERSION_MAJOR(deviceProperties.driverVersion), VK_VERSION_MINOR(deviceProperties.driverVersion),
00315             VK_VERSION_PATCH(deviceProperties.driverVersion));
00316             ImGui::TableNextColumn(); ImGui::Text("Vendor ID: %d", deviceProperties.vendorID);
00317             ImGui::TableNextColumn(); ImGui::Text("Device ID: %d", deviceProperties.deviceID);
00318             ImGui::TableNextColumn(); ImGui::Text("Device Type: %d", deviceProperties.deviceType);
00319             ImGui::TableNextColumn(); ImGui::Text("Discrete Queue Priorities: %d",
00320             deviceProperties.limits.discreteQueuePriorities);
00321             ImGui::TableNextColumn(); ImGui::Text("Max Push Constants Size: %d",
00322             deviceProperties.limits.maxPushConstantsSize);
00323             ImGui::TableNextColumn(); ImGui::Text("Max Memory Allocation Count: %d",
00324             deviceProperties.limits.maxMemoryAllocationCount);
00325             ImGui::TableNextColumn(); ImGui::Text("Max Image Dimension 1D: %d",
00326             deviceProperties.limits.maxImageDimension1D);
00327             ImGui::TableNextColumn(); ImGui::Text("Max Image Dimension 2D: %d",
00328             deviceProperties.limits.maxImageDimension2D);
00329             ImGui::TableNextColumn(); ImGui::Text("Max Image Dimension 3D: %d",
00330             deviceProperties.limits.maxImageDimension3D);
00331             ImGui::TableNextColumn(); ImGui::Text("Max Image Dimension Cube: %d",
00332             deviceProperties.limits.maxImageDimensionCube);
00333             ImGui::TableNextColumn(); ImGui::Text("Max Image Array Layers: %d",
00334             deviceProperties.limits.maxImageArrayLayers);
00335             ImGui::TableNextColumn(); ImGui::Text("Max Texel Buffer Elements: %d",
00336             deviceProperties.limits.maxTexelBufferElements);
00337             ImGui::TableNextColumn(); ImGui::Text("Max Uniform Buffer Range: %d",
00338             deviceProperties.limits.maxUniformBufferRange);
00339             ImGui::TableNextColumn(); ImGui::Text("Max Storage Buffer Range: %d",
00340             deviceProperties.limits.maxStorageBufferRange);
00341             ImGui::EndTable();
00342         }
00343     }
00344 }

```

8.74 /home/runner/work/VEngine/VEngine/src/Core/RenderSystems/base.cpp File Reference

```
#include "VEngine/Core/RenderSystem/ABase.hpp"
```

Include dependency graph for base.cpp:



8.75 base.cpp

[Go to the documentation of this file.](#)

```

00001 #include "VEngine/Core/RenderSystem/ABase.hpp"
00002
00003 void ven::ARenderSystemBase::createPipelineLayout(const VkDescriptorSetLayout globalSetLayout, const
uint32_t pushConstantSize)
00004 {
00005     VkPushConstantRange pushConstantRange{};
00006     pushConstantRange.stageFlags = VK_SHADER_STAGE_VERTEX_BIT | VK_SHADER_STAGE_FRAGMENT_BIT;
00007     pushConstantRange.offset = 0;
00008     pushConstantRange.size = pushConstantSize;
00009
00010     renderSystemLayout =
00011     DescriptorSetLayout::Builder(m_device)
00012         .addBinding(
00013             0,
00014             VK_DESCRIPTOR_TYPE_UNIFORM_BUFFER,
00015             VK_SHADER_STAGE_VERTEX_BIT | VK_SHADER_STAGE_FRAGMENT_BIT)
00016         .addBinding(1, VK_DESCRIPTOR_TYPE_COMBINED_IMAGE_SAMPLER, VK_SHADER_STAGE_FRAGMENT_BIT)
00017         .build();
00018
00019     const std::vector<VkDescriptorSetLayout> descriptorSetLayouts{
00020         globalSetLayout,
00021         renderSystemLayout->getDescriptorSetLayout()};
00022
00023     VkPipelineLayoutCreateInfo pipelineLayoutInfo{};
00024     pipelineLayoutInfo.sType = VK_STRUCTURE_TYPE_PIPELINE_LAYOUT_CREATE_INFO;
00025     pipelineLayoutInfo.setLayoutCount = static_cast<uint32_t>(descriptorSetLayouts.size());
00026     pipelineLayoutInfo.pSetLayouts = descriptorSetLayouts.data();
00027     pipelineLayoutInfo.pushConstantRangeCount = 1;
00028     pipelineLayoutInfo.pPushConstantRanges = &pushConstantRange;
00029     if (vkCreatePipelineLayout(m_device.device(), &pipelineLayoutInfo, nullptr, &m_pipelineLayout) !=
VK_SUCCESS)
00030     {
00031         throw std::runtime_error("Failed to create pipeline layout");
00032     }
00033 }
00034
00035 void ven::ARenderSystemBase::createPipeline(const VkRenderPass renderPass, const std::string
&shadersVertPath, const std::string &shadersFragPath, const bool isLight)
00036 {
00037     assert(m_pipelineLayout && "Cannot create pipeline before pipeline layout");

```

```

00038 PipelineConfigInfo pipelineConfig{};
00039 Shaders::defaultPipelineConfigInfo(pipelineConfig);
00040 if (isLight) {
00041     pipelineConfig.attributeDescriptions.clear();
00042     pipelineConfig.bindingDescriptions.clear();
00043 }
00044 pipelineConfig.renderPass = renderPass;
00045 pipelineConfig.pipelineLayout = m_pipelineLayout;
00046 m_shaders = std::make_unique<Shaders>(m_device, shadersVertPath, shadersFragPath, pipelineConfig);
00047 }

```

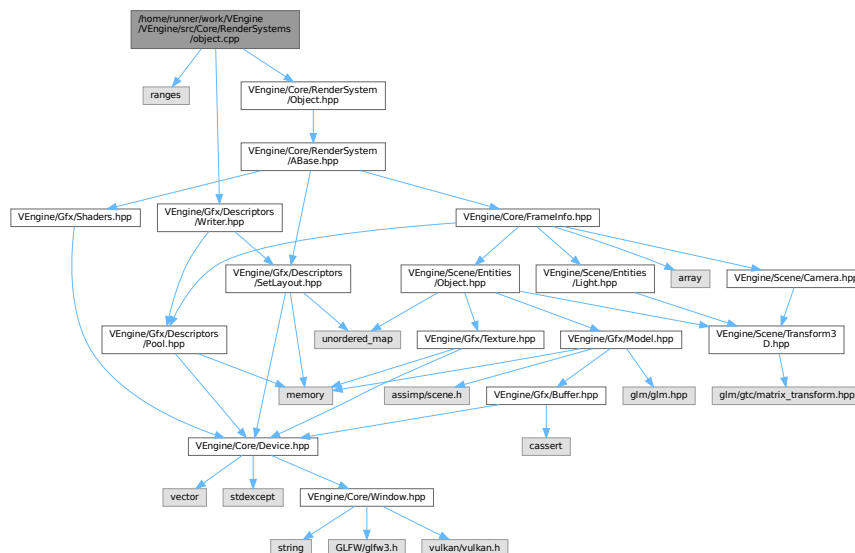
8.76 /home/runner/work/VEngine/VEngine/src/Core/Render Systems/object.cpp File Reference

```

#include <ranges>
#include "VEngine/Gfx/Descriptors/Writer.hpp"
#include "VEngine/Core/RenderSystem/Object.hpp"

```

Include dependency graph for object.cpp:



8.77 object.cpp

Go to the documentation of this file.

```

00001 #include <ranges>
00002
00003 #include "VEngine/Gfx/Descriptors/Writer.hpp"
00004 #include "VEngine/Core/RenderSystem/Object.hpp"
00005
00006 void ven::ObjectRenderSystem::render(const FrameInfo &frameInfo) const
00007 {
00008     getShaders()->bind(frameInfo.commandBuffer);
00009
00010     vkCmdBindDescriptorSets(frameInfo.commandBuffer, VK_PIPELINE_BIND_POINT_GRAPHICS,
00011                             getPipelineLayout(), 0, 1, &frameInfo.globalDescriptorSet, 0, nullptr);
00012
00013     for (Object& object : frameInfo.objects | std::views::values) {
00014         if (object.getModel() == nullptr) { continue; }
00015         auto bufferInfo = object.getBufferInfo(static_cast<int>(frameInfo.frameIndex));
00016         auto imageInfo = object.getDiffuseMap()->getImageInfo();
00017         VkDescriptorSet objectDescriptorSet = nullptr;
00018         DescriptorWriter(*renderSystemLayout, frameInfo.frameDescriptorPool)

```

```

00018         .writeBuffer(0, &bufferInfo)
00019         .writeImage(1, &imageInfo)
00020         .build(objectDescriptorSet);
00021
00022     vkCmdBindDescriptorSets(
00023         frameInfo.commandBuffer,
00024         VK_PIPELINE_BIND_POINT_GRAPHICS,
00025         getPipelineLayout(),
00026         1, // starting set (0 is the globalDescriptorSet, 1 is the set specific to this system)
00027         1, // set count
00028         &objectDescriptorSet,
00029         0,
00030         nullptr);
00031
00032     const ObjectPushConstantData push{
00033         .modelMatrix = object.transform.transformMatrix(),
00034         .normalMatrix = object.transform.normalMatrix()
00035     };
00036     vkCmdPushConstants(frameInfo.commandBuffer, getPipelineLayout(), VK_SHADER_STAGE_VERTEX_BIT |
VK_SHADER_STAGE_FRAGMENT_BIT, 0, sizeof(ObjectPushConstantData), &push);
00037     object.getModel()->bind(frameInfo.commandBuffer);
00038     object.getModel()->draw(frameInfo.commandBuffer);
00039 }
00040 }

```

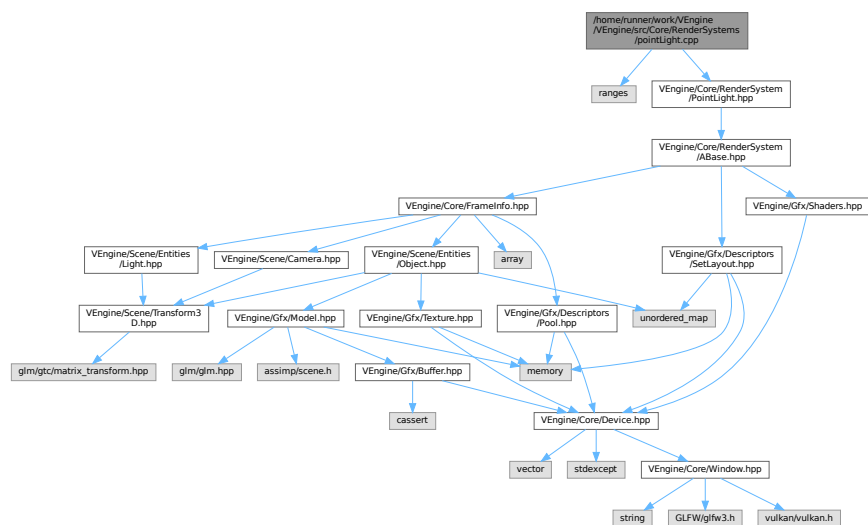
8.78 /home/runner/work/VEngine/VEngine/src/Core/RenderSystems/pointLight.cpp File Reference

```

#include <ranges>
#include "VEngine/Core/RenderSystem/PointLight.hpp"

```

Include dependency graph for pointLight.cpp:



8.79 pointLight.cpp

Go to the documentation of this file.

```

00001 #include <ranges>
00002
00003 #include "VEngine/Core/RenderSystem/PointLight.hpp"
00004
00005 void ven::PointLightRenderSystem::render(const FrameInfo &frameInfo) const
00006 {
00007     getShaders()->bind(frameInfo.commandBuffer);

```

```

00008     vkCmdBindDescriptorSets(frameInfo.commandBuffer, VK_PIPELINE_BIND_POINT_GRAPHICS,
getPipelineLayout(), 0, 1, &frameInfo.globalDescriptorSet, 0, nullptr);
00009
00010     for (const Light &light : frameInfo.lights | std::views::values) {
00011         const LightPushConstantData push{
00012             .position = glm::vec4(light.transform.translation, 1.F),
00013             .color = light.color,
00014             .radius = light.transform.scale.x
00015         };
00016         vkCmdPushConstants(frameInfo.commandBuffer, getPipelineLayout(), VK_SHADER_STAGE_VERTEX_BIT |
VK_SHADER_STAGE_FRAGMENT_BIT, 0, sizeof(LightPushConstantData), &push);
00017         vkCmdDraw(frameInfo.commandBuffer, 6, 1, 0, 0);
00018     }
00019 }

```

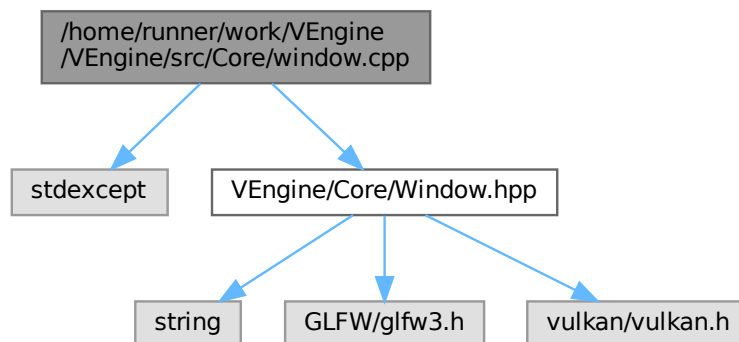
8.80 /home/runner/work/VEngine/VEngine/src/Core/window.cpp File Reference

```

#include <stdexcept>
#include "VEngine/Core/Window.hpp"

```

Include dependency graph for window.cpp:



8.81 window.cpp

[Go to the documentation of this file.](#)

```

00001 #include <stdexcept>
00002
00003 #include "VEngine/Core/Window.hpp"
00004
00005 GLFWwindow* ven::Window::createWindow(const uint32_t width, const uint32_t height, const std::string
&title)
00006 {
00007     if (glfwInit() == GLFW_FALSE) {
00008         throw std::runtime_error("Failed to initialize GLFW");
00009     }
00010
00011     glfwWindowHint(GLFW_CLIENT_API, GLFW_NO_API);
00012     glfwWindowHint(GLFW_RESIZABLE, GLFW_TRUE);
00013
00014     GLFWwindow *window = glfwCreateWindow(static_cast<int>(width), static_cast<int>(height),
title.c_str(), nullptr, nullptr);
00015     if (window == nullptr) {
00016         glfwTerminate();
00017         throw std::runtime_error("Failed to create window");
00018     }

```

```

00019     glfwSetWindowUserPointer(window, this);
00020     glfwSetFramebufferSizeCallback(window, framebufferResizeCallback);
00021     return window;
00022 }
00023
00024 void ven::Window::createWindowSurface(const VkInstance instance, VkSurfaceKHR *surface) const
00025 {
00026     if (glfwCreateWindowSurface(instance, m_window, nullptr, surface) != VK_SUCCESS) {
00027         throw std::runtime_error("Failed to create window surface");
00028     }
00029 }
00030
00031 void ven::Window::framebufferResizeCallback(GLFWwindow *window, const int width, const int height)
00032 {
00033     auto *app = static_cast<Window *>(glfwGetWindowUserPointer(window));
00034     app->m_framebufferResized = true;
00035     app->m_width = static_cast<uint32_t>(width);
00036     app->m_height = static_cast<uint32_t>(height);
00037 }
00038
00039 void ven::Window::setFullscreen(const bool fullscreen, const uint32_t width, const uint32_t height)
00040 {
00041     GLFWmonitor* primaryMonitor = glfwGetPrimaryMonitor();
00042     const GLFWvidmode* mode = glfwGetVideoMode(primaryMonitor);
00043
00044     /*
00045     if (fullscreen) {
00046         glfwSetWindowMonitor(m_window, primaryMonitor, 0, 0, mode->width, mode->height,
00047         mode->refreshRate);
00048     } else {
00049         // To restore a window that was originally windowed to its original size and position,
00050         // save these before making it full screen and then pass them in as above
00051         glfwSetWindowMonitor(m_window, nullptr, 0, 0, static_cast<int>(width),
00052         static_cast<int>(height), mode->refreshRate);
00053     }
00054     m_width = width;
00055     m_height = height;
00056     */
00057 }

```

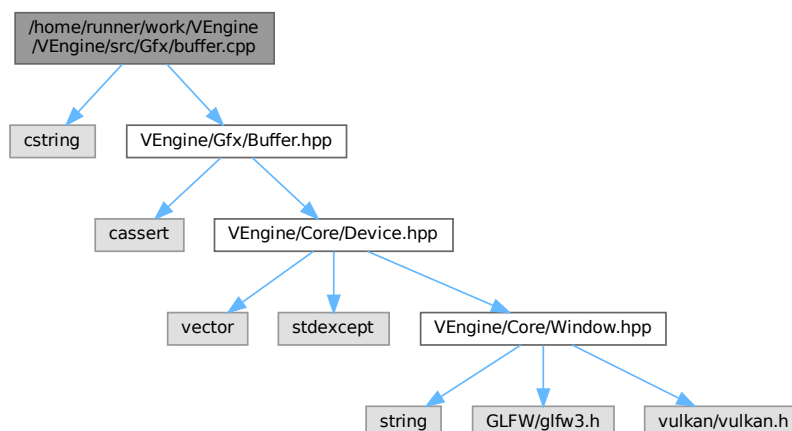
8.82 /home/runner/work/VEngine/VEngine/src/Gfx/buffer.cpp File Reference

```

#include <cstring>
#include "VEngine/Gfx/Buffer.hpp"

```

Include dependency graph for buffer.cpp:



8.83 buffer.cpp

[Go to the documentation of this file.](#)

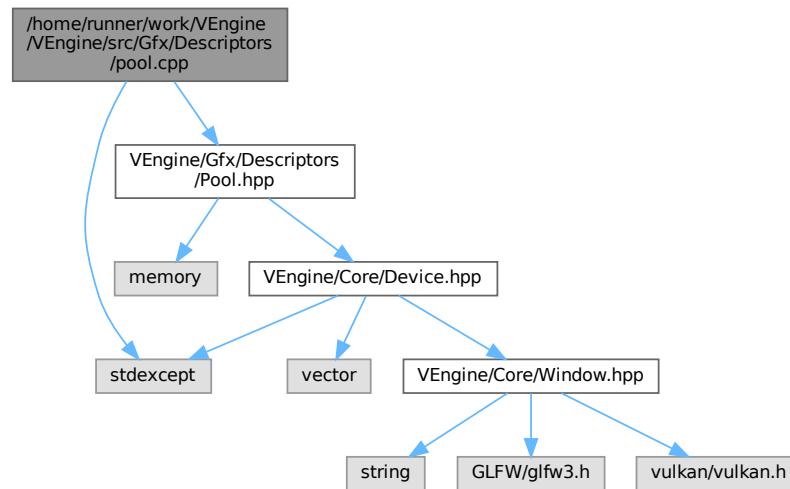
```
00001 #include <cstring>
00002
00003 #include "VEngine/Gfx/Buffer.hpp"
00004
00005 ven::Buffer::Buffer(Device &device, const VkDeviceSize instanceSize, const uint32_t instanceCount,
00006     const VkBufferUsageFlags usageFlags, const VkMemoryPropertyFlags memoryPropertyFlags, const
00007     VkDeviceSize minOffsetAlignment) : m_device{device}, m_instanceSize{instanceSize},
00008     m_instanceCount{instanceCount}, m_alignmentSize{getAlignment(instanceSize, minOffsetAlignment)},
00009     m_usageFlags{usageFlags}, m_memoryPropertyFlags{memoryPropertyFlags}
00010 {
00011     m_bufferSize = m_alignmentSize * m_instanceCount;
00012     device.createBuffer(m_bufferSize, m_usageFlags, m_memoryPropertyFlags, m_buffer, m_memory);
00013 }
00014
00015 ven::Buffer::~Buffer()
00016 {
00017     unmap();
00018     vkDestroyBuffer(m_device.device(), m_buffer, nullptr);
00019     vkFreeMemory(m_device.device(), m_memory, nullptr);
00020 }
00021
00022 VkResult ven::Buffer::map(const VkDeviceSize size, const VkDeviceSize offset)
00023 {
00024     assert(m_buffer && m_memory && "Called map on buffer before create");
00025     return vkMapMemory(m_device.device(), m_memory, offset, size, 0, &m_mapped);
00026 }
00027
00028 void ven::Buffer::unmap()
00029 {
00030     if (m_mapped != nullptr) {
00031         vkUnmapMemory(m_device.device(), m_memory);
00032         m_mapped = nullptr;
00033     }
00034 }
00035
00036 void ven::Buffer::writeToBuffer(const void *data, const VkDeviceSize size, const VkDeviceSize offset)
00037 const
00038 {
00039     assert(m_mapped && "Cannot copy to unmapped buffer");
00040
00041     if (size == VK_WHOLE_SIZE) {
00042         memcpy(m_mapped, data, m_bufferSize);
00043     } else {
00044         auto *memOffset = static_cast<char *>(m_mapped);
00045         memOffset += offset;
00046         memcpy(memOffset, data, size);
00047     }
00048 }
00049
00050 VkResult ven::Buffer::flush(const VkDeviceSize size, const VkDeviceSize offset) const
00051 {
00052     VkMappedMemoryRange mappedRange = {};
00053     mappedRange.sType = VK_STRUCTURE_TYPE_MAPPED_MEMORY_RANGE;
00054     mappedRange.memory = m_memory;
00055     mappedRange.offset = offset;
00056     mappedRange.size = size;
00057     return vkFlushMappedMemoryRanges(m_device.device(), 1, &mappedRange);
00058 }
00059
00060 VkResult ven::Buffer::invalidate(const VkDeviceSize size, const VkDeviceSize offset) const
00061 {
00062     VkMappedMemoryRange mappedRange = {};
00063     mappedRange.sType = VK_STRUCTURE_TYPE_MAPPED_MEMORY_RANGE;
00064     mappedRange.memory = m_memory;
00065     mappedRange.offset = offset;
00066     mappedRange.size = size;
00067     return vkInvalidateMappedMemoryRanges(m_device.device(), 1, &mappedRange);
00068 }
```

8.84 /home/runner/work/VEngine/VEngine/src/Gfx/Descriptors/pool.cpp

File Reference

```
#include <stdexcept>
#include "VEngine/Gfx/Descriptors/Pool.hpp"
```


Include dependency graph for pool.cpp:



8.85 pool.cpp

[Go to the documentation of this file.](#)

```

00001 #include <stdexcept>
00002
00003 #include "VEngine/Gfx/Descriptors/Pool.hpp"
00004
00005 ven::DescriptorPool::DescriptorPool(Device &device, const uint32_t maxSets, const
VkDescriptorPoolCreateFlags poolFlags, const std::vector<VkDescriptorPoolSize> &poolSizes) :
m_device(device)
00006 {
00007     VkDescriptorPoolCreateInfo descriptorPoolInfo{};
00008     descriptorPoolInfo.sType = VK_STRUCTURE_TYPE_DESCRIPTOR_POOL_CREATE_INFO;
00009     descriptorPoolInfo.poolSizeCount = static_cast<uint32_t>(poolSizes.size());
00010     descriptorPoolInfo.pPoolSizes = poolSizes.data();
00011     descriptorPoolInfo.maxSets = maxSets;
00012     descriptorPoolInfo.flags = poolFlags;
00013
00014     if (vkCreateDescriptorPool(m_device.device(), &descriptorPoolInfo, nullptr, &m_descriptorPool) !=
00015         VK_SUCCESS) {
00016         throw std::runtime_error("failed to create descriptor pool!");
00017     }
00018 }
00019
00020 bool ven::DescriptorPool::allocateDescriptor(const VkDescriptorSetLayout descriptorSetLayout,
VkDescriptorSet &descriptor) const
00021 {
00022     VkDescriptorSetAllocateInfo allocInfo{};
00023     allocInfo.sType = VK_STRUCTURE_TYPE_DESCRIPTOR_SET_ALLOCATE_INFO;
00024     allocInfo.descriptorPool = m_descriptorPool;
00025     allocInfo.pSetLayouts = &descriptorSetLayout;
00026     allocInfo.descriptorSetCount = 1;
00027
00028     // Might want to create a "DescriptorPoolManager" class that handles this case, and builds
00029     // a new pool whenever an old pool fills up. But this is beyond our current scope
00030     return vkAllocateDescriptorSets(m_device.device(), &allocInfo, &descriptor) == VK_SUCCESS;
00031 }

```

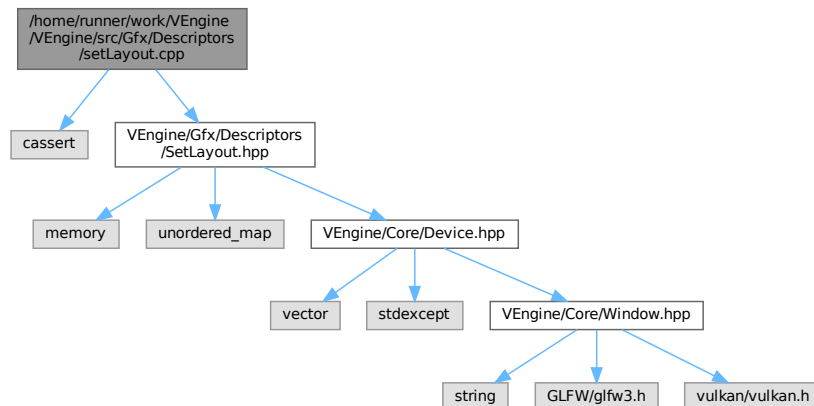
8.86 /home/runner/work/VEngine/VEngine/src/Gfx/Descriptors/setLayout.cpp File Reference

```

#include <cassert>
#include "VEngine/Gfx/Descriptors/SetLayout.hpp"

```

Include dependency graph for setLayout.cpp:



8.87 setLayout.cpp

[Go to the documentation of this file.](#)

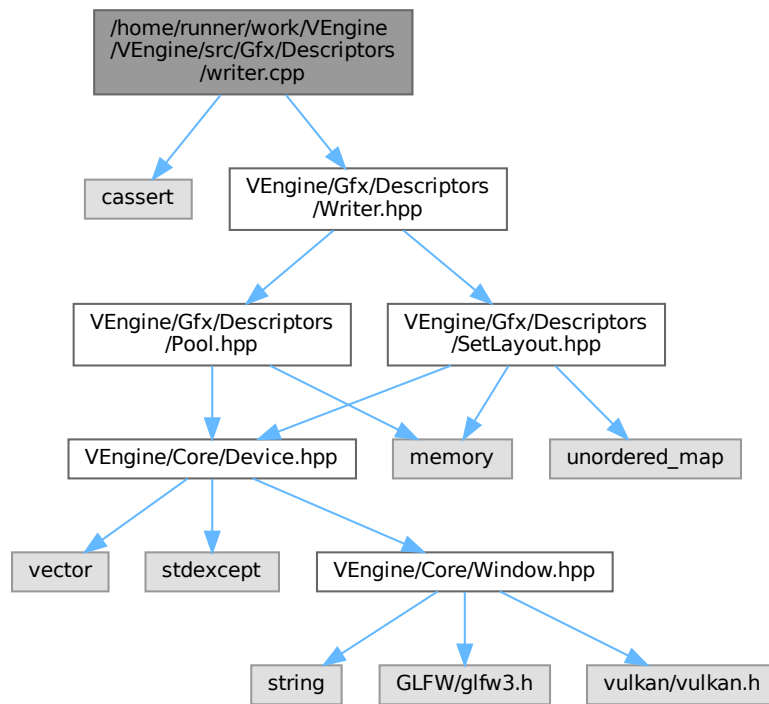
```

00001 #include <cassert>
00002
00003 #include "VEngine/Gfx/Descriptors/SetLayout.hpp"
00004
00005 ven::DescriptorSetLayout::Builder &ven::DescriptorSetLayout::Builder::addBinding(const uint32_t
binding, const VkDescriptorType descriptorType, const VkShaderStageFlags stageFlags, const uint32_t
count)
00006 {
00007     assert(m_bindings.contains(binding) == 0 && "Binding already exists in layout");
00008     VkDescriptorSetLayoutBinding layoutBinding{};
00009     layoutBinding.binding = binding;
00010     layoutBinding.descriptorType = descriptorType;
00011     layoutBinding.descriptorCount = count;
00012     layoutBinding.stageFlags = stageFlags;
00013     m_bindings[binding] = layoutBinding;
00014     return *this;
00015 }
00016
00017 ven::DescriptorSetLayout::DescriptorSetLayout(Device &device, const std::unordered_map<uint32_t,
VkDescriptorSetLayoutBinding>& bindings) : m_device{device}, m_bindings{bindings}
00018 {
00019     std::vector<VkDescriptorSetLayoutBinding> setLayoutBindings{};
00020     setLayoutBindings.reserve(bindings.size());
00021     for (auto [fst, snd] : bindings) {
00022         setLayoutBindings.push_back(snd);
00023     }
00024
00025     VkDescriptorSetLayoutCreateInfo descriptorSetLayoutInfo{};
00026     descriptorSetLayoutInfo.sType = VK_STRUCTURE_TYPE_DESCRIPTOR_SET_LAYOUT_CREATE_INFO;
00027     descriptorSetLayoutInfo.bindingCount = static_cast<uint32_t>(setLayoutBindings.size());
00028     descriptorSetLayoutInfo.pBindings = setLayoutBindings.data();
00029
00030     if (vkCreateDescriptorSetLayout (
00031         m_device.device(),
00032         &descriptorSetLayoutInfo,
00033         nullptr,
00034         &m_descriptorSetLayout) != VK_SUCCESS) {
00035         throw std::runtime_error("failed to create descriptor set layout!");
00036     }
00037 }

```

8.88 /home/runner/work/VEngine/VEngine/src/Gfx/Descriptors/writer.cpp File Reference

```
#include <cassert>
#include "VEngine/Gfx/Descriptors/Writer.hpp"
Include dependency graph for writer.cpp:
```



8.89 writer.cpp

[Go to the documentation of this file.](#)

```

00001 #include <cassert>
00002
00003 #include "VEngine/Gfx/Descriptors/Writer.hpp"
00004
00005 ven::DescriptorWriter &ven::DescriptorWriter::writeBuffer(const uint32_t binding, const
VkDescriptorBufferInfo *bufferInfo)
00006 {
00007     assert(m_setLayout.m_bindings.count(binding) == 1 && "Layout does not contain specified binding");
00008
00009     const auto &bindingDescription = m_setLayout.m_bindings.at(binding);
00010
00011     assert(bindingDescription.descriptorCount == 1 && "Binding single descriptor info, but binding
expects multiple");
00012
00013     VkWriteDescriptorSet write{};
00014     write.sType = VK_STRUCTURE_TYPE_WRITE_DESCRIPTOR_SET;
00015     write.descriptorType = bindingDescription.descriptorType;
00016     write.dstBinding = binding;
00017     write.pBufferInfo = bufferInfo;
00018     write.descriptorCount = 1;
00019
00020     m_writes.push_back(write);
00021     return *this;

```

```

00022 }
00023
00024 ven::DescriptorWriter &ven::DescriptorWriter::writeImage(const uint32_t binding, const
    VkDescriptorImageInfo *imageInfo)
00025 {
00026     assert(m_setLayout.m_bindings.count(binding) == 1 && "Layout does not contain specified binding");
00027     const VkDescriptorSetLayoutBinding &bindingDescription = m_setLayout.m_bindings.at(binding);
00028     assert(bindingDescription.descriptorCount == 1 && "Binding single descriptor info, but binding
    expects multiple");
00029
00030     VkWriteDescriptorSet write{};
00031     write.sType = VK_STRUCTURE_TYPE_WRITE_DESCRIPTOR_SET;
00032     write.descriptorType = bindingDescription.descriptorType;
00033     write.dstBinding = binding;
00034     write.pImageInfo = imageInfo;
00035     write.descriptorCount = 1;
00036
00037     m_writes.push_back(write);
00038     return *this;
00039 }
00040
00041 bool ven::DescriptorWriter::build(VkDescriptorSet &set)
00042 {
00043     if (!m_pool.allocateDescriptor(m_setLayout.getDescriptorSetLayout(), set)) {
00044         return false;
00045     }
00046     overwrite(set);
00047     return true;
00048 }
00049
00050 void ven::DescriptorWriter::overwrite(const VkDescriptorSet &set) {
00051     for (auto &[sType, pNext, dstSet, dstBinding, dstArrayElement, descriptorCount, descriptorType,
    pImageInfo, pBufferInfo, pTexelBufferView] : m_writes) {
00052         dstSet = set;
00053     }
00054     vkUpdateDescriptorSets(m_pool.m_device.device(), static_cast<unsigned int>(m_writes.size()),
    m_writes.data(), 0, nullptr);
00055 }
00056
00057 }

```

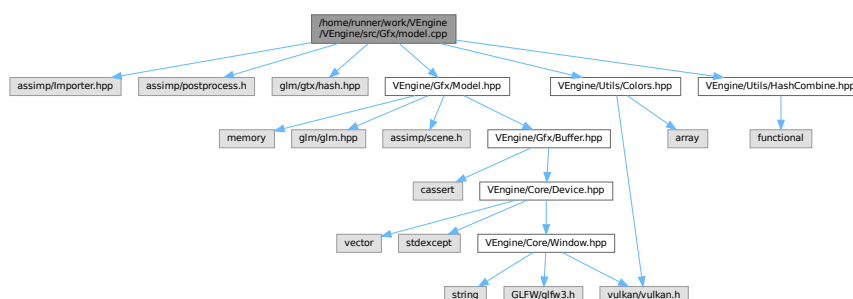
8.90 /home/runner/work/VEngine/VEngine/src/Gfx/model.cpp File Reference

```

#include <assimp/Importer.hpp>
#include <assimp/postprocess.h>
#include <glm/gtx/hash.hpp>
#include "VEngine/Gfx/Model.hpp"
#include "VEngine/Utils/Colors.hpp"
#include "VEngine/Utils/HashCombine.hpp"

```

Include dependency graph for model.cpp:



Classes

- struct `std::hash< ven::Model::Vertex >`

Macros

- `#define GLM_ENABLE_EXPERIMENTAL`

8.90.1 Macro Definition Documentation

8.90.1.1 GLM_ENABLE_EXPERIMENTAL

```
#define GLM_ENABLE_EXPERIMENTAL
```

Definition at line 4 of file [model.cpp](#).

8.91 model.cpp

[Go to the documentation of this file.](#)

```
00001 #include <assimp/Importer.hpp>
00002 #include <assimp/postprocess.h>
00003
00004 #define GLM_ENABLE_EXPERIMENTAL
00005 #include <glm/gtx/hash.hpp>
00006
00007 #include "VEngine/Gfx/Model.hpp"
00008 #include "VEngine/Utils/Colors.hpp"
00009 #include "VEngine/Utils/HashCombine.hpp"
00010
00011 template<>
00012 struct std::hash<ven::Model::Vertex> {
00013     size_t operator() (ven::Model::Vertex const &vertex) const noexcept {
00014         size_t seed = 0;
00015         ven::hashCombine(seed, vertex.position, vertex.color, vertex.normal, vertex.uv);
00016         return seed;
00017     }
00018 };
00019
00020 ven::Model::Model(Device &device, const Builder &builder) : m_device{device}, m_vertexCount(0),
    m_indexCount(0)
00021 {
00022     createVertexBuffer(builder.vertices);
00023     createIndexBuffer(builder.indices);
00024 }
00025
00026 void ven::Model::createVertexBuffer(const std::vector<Vertex> &vertices)
00027 {
00028     m_vertexCount = static_cast<uint32_t>(vertices.size());
00029     assert(m_vertexCount >= 3 && "Vertex count must be at least 3");
00030     constexpr unsigned long vertexSize = sizeof(vertices[0]);
00031     const VkDeviceSize bufferSize = vertexSize * m_vertexCount;
00032
00033     Buffer stagingBuffer{m_device, vertexSize, m_vertexCount, VK_BUFFER_USAGE_TRANSFER_SRC_BIT,
    VK_MEMORY_PROPERTY_HOST_VISIBLE_BIT | VK_MEMORY_PROPERTY_HOST_COHERENT_BIT};
00034
00035     stagingBuffer.map();
00036     stagingBuffer.writeToBuffer(vertices.data());
00037
00038     m_vertexBuffer = std::make_unique<Buffer>(m_device, vertexSize, m_vertexCount,
    VK_BUFFER_USAGE_VERTEX_BUFFER_BIT | VK_BUFFER_USAGE_TRANSFER_DST_BIT,
    VK_MEMORY_PROPERTY_DEVICE_LOCAL_BIT);
00039
00040     m_device.copyBuffer(stagingBuffer.getBuffer(), m_vertexBuffer->getBuffer(), bufferSize);
00041 }
00042
00043 void ven::Model::createIndexBuffer(const std::vector<uint32_t> &indices)
00044 {
00045     m_indexCount = static_cast<uint32_t>(indices.size());
00046     m_hasIndexBuffer = m_indexCount > 0;
00047
00048     if (!m_hasIndexBuffer) {
00049         return;
00050     }
00051
00052     constexpr uint32_t indexSize = sizeof(indices[0]);
00053 }
```

```

00054     Buffer stagingBuffer{m_device, indexSize, m_indexCount, VK_BUFFER_USAGE_TRANSFER_SRC_BIT,
VK_MEMORY_PROPERTY_HOST_VISIBLE_BIT | VK_MEMORY_PROPERTY_HOST_COHERENT_BIT};
00055
00056     stagingBuffer.map();
00057     stagingBuffer.writeToBuffer(indices.data());
00058
00059     m_indexBuffer = std::make_unique<Buffer>(m_device, indexSize, m_indexCount,
VK_BUFFER_USAGE_INDEX_BUFFER_BIT | VK_BUFFER_USAGE_TRANSFER_DST_BIT,
VK_MEMORY_PROPERTY_DEVICE_LOCAL_BIT);
00060
00061     m_device.copyBuffer(stagingBuffer.getBuffer(), m_indexBuffer->getBuffer(), sizeof(indices[0]) *
m_indexCount);
00062 }
00063
00064 void ven::Model::draw(const VkCommandBuffer commandBuffer) const
00065 {
00066     if (m_hasIndexBuffer) {
00067         vkCmdDrawIndexed(commandBuffer, m_indexCount, 1, 0, 0, 0);
00068     } else {
00069         vkCmdDraw(commandBuffer, m_vertexCount, 1, 0, 0);
00070     }
00071 }
00072
00073 void ven::Model::bind(const VkCommandBuffer commandBuffer) const
00074 {
00075     const std::array buffers{m_vertexBuffer->getBuffer()};
00076     constexpr std::array<VkDeviceSize, 1> offsets{0};
00077     vkCmdBindVertexBuffers(commandBuffer, 0, 1, buffers.data(), offsets.data());
00078
00079     if (m_hasIndexBuffer) {
00080         vkCmdBindIndexBuffer(commandBuffer, m_indexBuffer->getBuffer(), 0, VK_INDEX_TYPE_UINT32);
00081     }
00082 }
00083
00084 std::unique_ptr<ven::Model> ven::Model::createModelFromFile(Device &device, const std::string
&filename)
00085 {
00086     Builder builder{};
00087     builder.loadModel(filename);
00088     return std::make_unique<Model>(device, builder);
00089 }
00090
00091 std::vector<VkVertexInputBindingDescription> ven::Model::Vertex::getBindingDescriptions()
00092 {
00093     std::vector<VkVertexInputBindingDescription> bindingDescriptions(1);
00094     bindingDescriptions[0].binding = 0;
00095     bindingDescriptions[0].stride = sizeof(Vertex);
00096     bindingDescriptions[0].inputRate = VK_VERTEX_INPUT_RATE_VERTEX;
00097     return bindingDescriptions;
00098 }
00099
00100 std::vector<VkVertexInputAttributeDescription> ven::Model::Vertex::getAttributeDescriptions()
00101 {
00102     std::vector<VkVertexInputAttributeDescription> attributeDescriptions{};
00103
00104     attributeDescriptions.push_back({0, 0, VK_FORMAT_R32G32B32_SFLOAT, offsetof(Vertex, position)});
00105     attributeDescriptions.push_back({1, 0, VK_FORMAT_R32G32B32_SFLOAT, offsetof(Vertex, color)});
00106     attributeDescriptions.push_back({2, 0, VK_FORMAT_R32G32B32_SFLOAT, offsetof(Vertex, normal)});
00107     attributeDescriptions.push_back({3, 0, VK_FORMAT_R32G32_SFLOAT, offsetof(Vertex, uv)});
00108
00109     return attributeDescriptions;
00110 }
00111
00112 void ven::Model::Builder::loadModel(const std::string &filename) {
00113     Assimp::Importer importer;
00114
00115     const aiScene* scene = importer.ReadFile(filename, aiProcess_Triangulate | aiProcess_FlipUVs |
aiProcess_CalcTangentSpace | aiProcess_GenNormals);
00116
00117     if ((scene == nullptr) || ((scene->mFlags & AI_SCENE_FLAGS_INCOMPLETE) != 0U) || (scene->mRootNode
== nullptr)) {
00118         throw std::runtime_error("Failed to load model with Assimp: " +
std::string(importer.GetErrorString()));
00119     }
00120
00121     vertices.clear();
00122     indices.clear();
00123
00124     processNode(scene->mRootNode, scene);
00125 }
00126
00127 void ven::Model::Builder::processNode(const aiNode* node, const aiScene* scene) {
00128     for (unsigned int i = 0; i < node->mNumMeshes; i++) {
00129         const aiMesh* mesh = scene->mMeshes[node->mMeshes[i]];
00130         processMesh(mesh, scene);
00131     }
00132 }

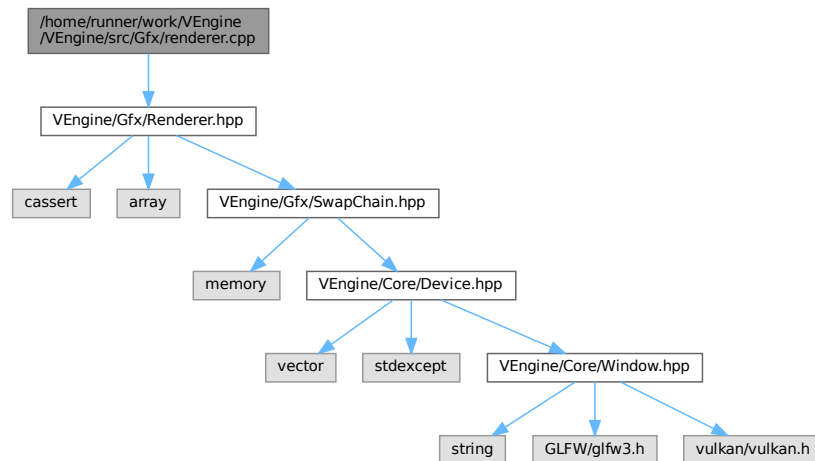
```

```
00133     for (unsigned int i = 0; i < node->mNumChildren; i++) {
00134         processNode(node->mChildren[i], scene);
00135     }
00136 }
00137
00138 void ven::Model::Builder::processMesh(const aiMesh* mesh, const aiScene* scene) {
00139     std::unordered_map<Vertex, uint32_t> uniqueVertices;
00140
00141     for (unsigned int i = 0; i < mesh->mNumVertices; i++) {
00142         Vertex vertex{};
00143
00144         vertex.position = glm::vec3(
00145             mesh->mVertices[i].x,
00146             mesh->mVertices[i].y,
00147             mesh->mVertices[i].z
00148         );
00149
00150         if (mesh->HasNormals()) {
00151             vertex.normal = glm::vec3(
00152                 mesh->mNormals[i].x,
00153                 mesh->mNormals[i].y,
00154                 mesh->mNormals[i].z
00155             );
00156         }
00157
00158         if (mesh->mTextureCoords[0] != nullptr) {
00159             vertex.uv = glm::vec2(
00160                 mesh->mTextureCoords[0][i].x,
00161                 mesh->mTextureCoords[0][i].y
00162             );
00163         } else {
00164             vertex.uv = glm::vec2(0.0F, 0.0F);
00165         }
00166
00167         if (vertex.color == Colors::BLACK_3) {
00168             vertex.color = Colors::WHITE_3;
00169         }
00170
00171         if (!uniqueVertices.contains(vertex)) {
00172             uniqueVertices[vertex] = static_cast<uint32_t>(vertices.size());
00173             vertices.push_back(vertex);
00174         }
00175
00176         indices.push_back(uniqueVertices[vertex]);
00177     }
00178 }
00179
```

8.92 /home/runner/work/VEngine/VEngine/src/Gfx/renderer.cpp File Reference

```
#include "VEngine/Gfx/Renderer.hpp"
```

Include dependency graph for renderer.cpp:



8.93 renderer.cpp

[Go to the documentation of this file.](#)

```

00001 #include "VEngine/Gfx/Renderer.hpp"
00002
00003 void ven::Renderer::createCommandBuffers()
00004 {
00005     m_commandBuffers.resize(MAX_FRAMES_IN_FLIGHT);
00006     VkCommandBufferAllocateInfo allocInfo{};
00007     allocInfo.sType = VK_STRUCTURE_TYPE_COMMAND_BUFFER_ALLOCATE_INFO;
00008     allocInfo.level = VK_COMMAND_BUFFER_LEVEL_PRIMARY;
00009     allocInfo.commandPool = m_device.getCommandPool();
00010     allocInfo.commandBufferCount = static_cast<uint32_t>(m_commandBuffers.size());
00011
00012     if (vkAllocateCommandBuffers(m_device.device(), &allocInfo, m_commandBuffers.data()) !=
VK_SUCCESS) {
00013         throw std::runtime_error("Failed to allocate command buffers");
00014     }
00015 }
00016
00017 void ven::Renderer::freeCommandBuffers()
00018 {
00019     vkFreeCommandBuffers(m_device.device(), m_device.getCommandPool(),
static_cast<uint32_t>(m_commandBuffers.size()), m_commandBuffers.data());
00020     m_commandBuffers.clear();
00021 }
00022
00023 void ven::Renderer::recreateSwapChain()
00024 {
00025     VkExtent2D extent = m_window.getExtent();
00026     while (extent.width == 0 || extent.height == 0) {
00027         extent = m_window.getExtent();
00028         glfwWaitEvents();
00029     }
00030     vkDeviceWaitIdle(m_device.device());
00031     if (m_swapChain == nullptr) {
00032         m_swapChain = std::make_unique<SwapChain>(m_device, extent);
00033     } else {
00034         std::shared_ptr<SwapChain> oldSwapChain = std::move(m_swapChain);
00035         m_swapChain = std::make_unique<SwapChain>(m_device, extent, oldSwapChain);
00036         if (!oldSwapChain->compareSwapFormats(*m_swapChain)) {

```



```

00037         throw std::runtime_error("Swap chain image/depth format changed");
00038     }
00039 }
00040 // well be back
00041 }
00042
00043 VkCommandBuffer ven::Renderer::beginFrame()
00044 {
00045     assert(!m_isFrameStarted && "Can't start new frame while previous one is still in progress");
00046
00047     const VkResult result = m_swapChain->acquireNextImage(&m_currentImageIndex);
00048     if (result == VK_ERROR_OUT_OF_DATE_KHR) {
00049         recreateSwapChain();
00050         return nullptr;
00051     }
00052
00053     if (result != VK_SUCCESS && result != VK_SUBOPTIMAL_KHR) {
00054         throw std::runtime_error("Failed to acquire swap chain image");
00055     }
00056
00057     m_isFrameStarted = true;
00058
00059     VkCommandBuffer_T *commandBuffer = getCurrentCommandBuffer();
00060     VkCommandBufferBeginInfo beginInfo{};
00061     beginInfo.sType = VK_STRUCTURE_TYPE_COMMAND_BUFFER_BEGIN_INFO;
00062
00063     if (vkBeginCommandBuffer(commandBuffer, &beginInfo) != VK_SUCCESS) {
00064         throw std::runtime_error("Failed to begin recording command m_buffer");
00065     }
00066     return commandBuffer;
00067 }
00068
00069 void ven::Renderer::endFrame()
00070 {
00071     assert(m_isFrameStarted && "Can't end frame that hasn't been started");
00072
00073     VkCommandBuffer_T *commandBuffer = getCurrentCommandBuffer();
00074     if (vkEndCommandBuffer(commandBuffer) != VK_SUCCESS) {
00075         throw std::runtime_error("Failed to record command buffer");
00076     }
00077     if (const VkResult result = m_swapChain->submitCommandBuffers(&commandBuffer,
&m_currentImageIndex); result == VK_ERROR_OUT_OF_DATE_KHR || result == VK_SUBOPTIMAL_KHR ||
m_window.wasWindowResized()) {
00078         m_window.resetWindowResizedFlag();
00079         recreateSwapChain();
00080     }
00081     else if (result != VK_SUCCESS) {
00082         throw std::runtime_error("Failed to submit command buffer");
00083     }
00084
00085     m_isFrameStarted = false;
00086     m_currentFrameIndex = (m_currentFrameIndex + 1) % MAX_FRAMES_IN_FLIGHT;
00087 }
00088
00089 void ven::Renderer::beginSwapChainRenderPass(const VkCommandBuffer commandBuffer) const
00090 {
00091     assert(m_isFrameStarted && "Can't begin render pass when frame not in progress");
00092     assert(commandBuffer == getCurrentCommandBuffer() && "Can't begin render pass on command m_buffer
from a different frame");
00093
00094     VkRenderPassBeginInfo renderPassInfo{};
00095     renderPassInfo.sType = VK_STRUCTURE_TYPE_RENDER_PASS_BEGIN_INFO;
00096     renderPassInfo.renderPass = m_swapChain->getRenderPass();
00097     renderPassInfo.framebuffer = m_swapChain->getFramebuffer(m_currentImageIndex);
00098
00099     renderPassInfo.renderArea.offset = {.x=0, .y=0};
00100     renderPassInfo.renderArea.extent = m_swapChain->getSwapChainExtent();
00101
00102     renderPassInfo.clearValueCount = static_cast<uint32_t>(m_clearValues.size());
00103     renderPassInfo.pClearValues = m_clearValues.data();
00104
00105     vkCmdBeginRenderPass(commandBuffer, &renderPassInfo, VK_SUBPASS_CONTENTS_INLINE);
00106
00107     VkViewport viewport{};
00108     viewport.x = 0.0F;
00109     viewport.y = 0.0F;
00110     viewport.width = static_cast<float>(m_swapChain->getSwapChainExtent().width);
00111     viewport.height = static_cast<float>(m_swapChain->getSwapChainExtent().height);
00112     viewport.minDepth = 0.0F;
00113     viewport.maxDepth = 1.0F;
00114     const VkRect2D scissor{{0, 0}, m_swapChain->getSwapChainExtent()};
00115     vkCmdSetViewport(commandBuffer, 0, 1, &viewport);
00116     vkCmdSetScissor(commandBuffer, 0, 1, &scissor);
00117 }
00118
00119 void ven::Renderer::endSwapChainRenderPass(const VkCommandBuffer commandBuffer) const
00120 {

```

```

00121     assert(m_isFrameStarted && "Can't end render pass when frame not in progress");
00122     assert(commandBuffer == getCurrentCommandBuffer() && "Can't end render pass on command m_buffer
    from a different frame");
00123
00124     vkCmdEndRenderPass(commandBuffer);
00125 }

```

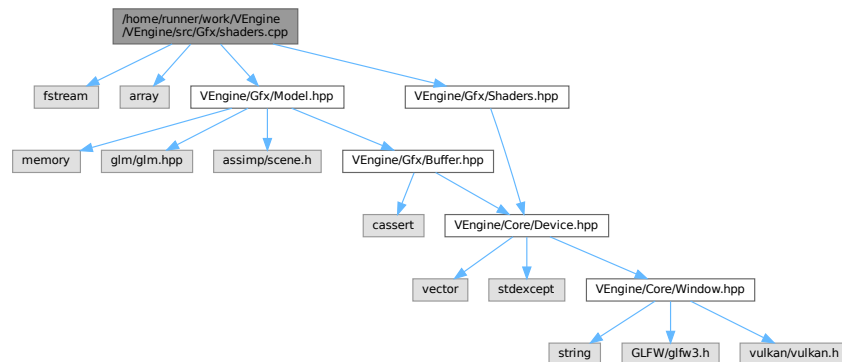
8.94 /home/runner/work/VEngine/VEngine/src/Gfx/shaders.cpp File Reference

```

#include <fstream>
#include <array>
#include "VEngine/Gfx/Model.hpp"
#include "VEngine/Gfx/Shaders.hpp"

```

Include dependency graph for shaders.cpp:



8.95 shaders.cpp

[Go to the documentation of this file.](#)

```

00001 #include <fstream>
00002 #include <array>
00003
00004 #include "VEngine/Gfx/Model.hpp"
00005 #include "VEngine/Gfx/Shaders.hpp"
00006
00007 ven::Shaders::~Shaders()
00008 {
00009     vkDestroyShaderModule(m_device.device(), m_vertShaderModule, nullptr);
00010     vkDestroyShaderModule(m_device.device(), m_fragShaderModule, nullptr);
00011     vkDestroyPipeline(m_device.device(), m_graphicsPipeline, nullptr);
00012 }
00013
00014 std::vector<char> ven::Shaders::readFile(const std::string &filename) {
00015     std::ifstream file(filename, std::ios::binary | std::ios::ate);
00016     if (!file.is_open()) {
00017         throw std::runtime_error("failed to open file!");
00018     }
00019
00020     const long int fileSize = file.tellg();
00021     std::vector<char> buffer(static_cast<long unsigned int>(fileSize));
00022     file.seekg(0);
00023     file.read(buffer.data(), fileSize);
00024     return buffer;
00025 }
00026
00027 void ven::Shaders::createGraphicsPipeline(const std::string& vertFilepath, const std::string&
    fragFilepath, const PipelineConfigInfo& configInfo)
00028 {

```

```

00029     const std::vector<char> vertCode = readFile(vertFilepath);
00030     const std::vector<char> fragCode = readFile(fragFilepath);
00031
00032     createShaderModule(vertCode, &m_vertShaderModule);
00033     createShaderModule(fragCode, &m_fragShaderModule);
00034
00035     std::array<VkPipelineShaderStageCreateInfo, 2> shaderStages{};
00036     shaderStages[0].sType = VK_STRUCTURE_TYPE_PIPELINE_SHADER_STAGE_CREATE_INFO;
00037     shaderStages[0].stage = VK_SHADER_STAGE_VERTEX_BIT;
00038     shaderStages[0].module = m_vertShaderModule;
00039     shaderStages[0].pName = "main";
00040     shaderStages[0].flags = 0;
00041     shaderStages[0].pNext = nullptr;
00042     shaderStages[0].pSpecializationInfo = nullptr;
00043
00044     shaderStages[1].sType = VK_STRUCTURE_TYPE_PIPELINE_SHADER_STAGE_CREATE_INFO;
00045     shaderStages[1].stage = VK_SHADER_STAGE_FRAGMENT_BIT;
00046     shaderStages[1].module = m_fragShaderModule;
00047     shaderStages[1].pName = "main";
00048     shaderStages[1].flags = 0;
00049     shaderStages[1].pNext = nullptr;
00050     shaderStages[1].pSpecializationInfo = nullptr;
00051
00052     const auto& bindingDescriptions = configInfo.bindingDescriptions;
00053     const auto& attributeDescriptions = configInfo.attributeDescriptions;
00054     VkPipelineVertexInputStateCreateInfo vertexInputInfo{};
00055     vertexInputInfo.sType = VK_STRUCTURE_TYPE_PIPELINE_VERTEX_INPUT_STATE_CREATE_INFO;
00056     vertexInputInfo.vertexAttributeDescriptionCount =
00057         static_cast<uint32_t>(attributeDescriptions.size());
00057     vertexInputInfo.vertexBindingDescriptionCount = static_cast<uint32_t>(bindingDescriptions.size());
00058     vertexInputInfo.pVertexAttributeDescriptions = attributeDescriptions.data();
00059     vertexInputInfo.pVertexBindingDescriptions = bindingDescriptions.data();
00060
00061
00062     VkPipelineViewportStateCreateInfo viewportInfo{};
00063     viewportInfo.sType = VK_STRUCTURE_TYPE_PIPELINE_VIEWPORT_STATE_CREATE_INFO;
00064     viewportInfo.viewportCount = 1;
00065     viewportInfo.pViewports = nullptr;
00066     viewportInfo.scissorCount = 1;
00067     viewportInfo.pScissors = nullptr;
00068
00069
00070     VkGraphicsPipelineCreateInfo pipelineInfo{};
00071     pipelineInfo.sType = VK_STRUCTURE_TYPE_GRAPHICS_PIPELINE_CREATE_INFO;
00072     pipelineInfo.stageCount = 2;
00073     pipelineInfo.pStages = shaderStages.data();
00074     pipelineInfo.pVertexInputState = &vertexInputInfo;
00075     pipelineInfo.pInputAssemblyState = &configInfo.inputAssemblyInfo;
00076     pipelineInfo.pViewportState = &viewportInfo;
00077     pipelineInfo.pRasterizationState = &configInfo.rasterizationInfo;
00078     pipelineInfo.pMultisampleState = &configInfo.multisampleInfo;
00079
00080     pipelineInfo.pColorBlendState = &configInfo.colorBlendInfo;
00081     pipelineInfo.pDepthStencilState = &configInfo.depthStencilInfo;
00082     pipelineInfo.pDynamicState = &configInfo.dynamicStateInfo;
00083
00084     pipelineInfo.layout = configInfo.pipelineLayout;
00085     pipelineInfo.renderPass = configInfo.renderPass;
00086     pipelineInfo.subpass = configInfo.subpass;
00087
00088     pipelineInfo.basePipelineIndex = -1;
00089     pipelineInfo.basePipelineHandle = VK_NULL_HANDLE;
00090
00091     if (vkCreateGraphicsPipelines(m_device.device(), VK_NULL_HANDLE, 1, &pipelineInfo, nullptr,
00092         &m_graphicsPipeline) != VK_SUCCESS) {
00092         throw std::runtime_error("failed to create graphics pipeline");
00093     }
00094 }
00095
00096 void ven::Shaders::createShaderModule(const std::vector<char> &code, VkShaderModule *shaderModule)
00097 {
00098     const
00099     VkShaderModuleCreateInfo createInfo{};
00100     createInfo.sType = VK_STRUCTURE_TYPE_SHADER_MODULE_CREATE_INFO;
00101     createInfo.codeSize = code.size();
00102     createInfo.pCode = reinterpret_cast<const uint32_t*>(code.data());
00103
00104     if (vkCreateShaderModule(m_device.device(), &createInfo, nullptr, shaderModule) != VK_SUCCESS) {
00104         throw std::runtime_error("failed to create shader module");
00105     }
00106 }
00107
00108 void ven::Shaders::defaultPipelineConfigInfo(PipelineConfigInfo& configInfo)
00109 {
00110     configInfo.inputAssemblyInfo.sType = VK_STRUCTURE_TYPE_PIPELINE_INPUT_ASSEMBLY_STATE_CREATE_INFO;
00111     configInfo.inputAssemblyInfo.topology = VK_PRIMITIVE_TOPOLOGY_TRIANGLE_LIST;
00112     configInfo.inputAssemblyInfo.primitiveRestartEnable = VK_FALSE;

```

```

00113
00114     configInfo.rasterizationInfo.sType = VK_STRUCTURE_TYPE_PIPELINE_RASTERIZATION_STATE_CREATE_INFO;
00115     configInfo.rasterizationInfo.depthClampEnable = VK_FALSE;
00116     configInfo.rasterizationInfo.rasterizerDiscardEnable = VK_FALSE;
00117     configInfo.rasterizationInfo.polygonMode = VK_POLYGON_MODE_FILL;
00118     configInfo.rasterizationInfo.lineWidth = 1.0F;
00119     configInfo.rasterizationInfo.cullMode = VK_CULL_MODE_NONE; // to enable later
(VK_CULL_MODE_BACK_BIT) back-face culling
00120     configInfo.rasterizationInfo.frontFace = VK_FRONT_FACE_COUNTER_CLOCKWISE;
00121     configInfo.rasterizationInfo.depthBiasEnable = VK_FALSE;
00122     configInfo.rasterizationInfo.depthBiasConstantFactor = 0.0F;
00123     configInfo.rasterizationInfo.depthBiasClamp = 0.0F;
00124     configInfo.rasterizationInfo.depthBiasSlopeFactor = 0.0F;
00125
00126     configInfo.multisampleInfo.sType = VK_STRUCTURE_TYPE_PIPELINE_MULTISAMPLE_STATE_CREATE_INFO;
00127     configInfo.multisampleInfo.sampleShadingEnable = VK_FALSE;
00128     configInfo.multisampleInfo.rasterizationSamples = VK_SAMPLE_COUNT_1_BIT;
00129     configInfo.multisampleInfo.minSampleShading = 1.0F;
00130     configInfo.multisampleInfo.pSampleMask = nullptr;
00131     configInfo.multisampleInfo.alphaToCoverageEnable = VK_FALSE;
00132     configInfo.multisampleInfo.alphaToOneEnable = VK_FALSE;
00133
00134     configInfo.colorBlendAttachment.colorWriteMask = VK_COLOR_COMPONENT_R_BIT |
VK_COLOR_COMPONENT_G_BIT | VK_COLOR_COMPONENT_B_BIT | VK_COLOR_COMPONENT_A_BIT;
00135     configInfo.colorBlendAttachment.blendEnable = VK_FALSE;
00136     configInfo.colorBlendAttachment.srcColorBlendFactor = VK_BLEND_FACTOR_ONE;
00137     configInfo.colorBlendAttachment.dstColorBlendFactor = VK_BLEND_FACTOR_ZERO;
00138     configInfo.colorBlendAttachment.colorBlendOp = VK_BLEND_OP_ADD;
00139     configInfo.colorBlendAttachment.srcAlphaBlendFactor = VK_BLEND_FACTOR_ONE;
00140     configInfo.colorBlendAttachment.dstAlphaBlendFactor = VK_BLEND_FACTOR_ZERO;
00141     configInfo.colorBlendAttachment.alphaBlendOp = VK_BLEND_OP_ADD;
00142
00143     configInfo.colorBlendInfo.sType = VK_STRUCTURE_TYPE_PIPELINE_COLOR_BLEND_STATE_CREATE_INFO;
00144     configInfo.colorBlendInfo.logicOpEnable = VK_FALSE;
00145     configInfo.colorBlendInfo.logicOp = VK_LOGIC_OP_COPY;
00146     configInfo.colorBlendInfo.attachmentCount = 1;
00147     configInfo.colorBlendInfo.pAttachments = &configInfo.colorBlendAttachment;
00148     configInfo.colorBlendInfo.blendConstants[0] = 0.0F;
00149     configInfo.colorBlendInfo.blendConstants[1] = 0.0F;
00150     configInfo.colorBlendInfo.blendConstants[2] = 0.0F;
00151     configInfo.colorBlendInfo.blendConstants[3] = 0.0F;
00152
00153     configInfo.depthStencilInfo.sType = VK_STRUCTURE_TYPE_PIPELINE_DEPTH_STENCIL_STATE_CREATE_INFO;
00154     configInfo.depthStencilInfo.depthTestEnable = VK_TRUE;
00155     configInfo.depthStencilInfo.depthWriteEnable = VK_TRUE;
00156     configInfo.depthStencilInfo.depthCompareOp = VK_COMPARE_OP_LESS;
00157     configInfo.depthStencilInfo.depthBoundsTestEnable = VK_FALSE;
00158     configInfo.depthStencilInfo.minDepthBounds = 0.0F;
00159     configInfo.depthStencilInfo.maxDepthBounds = 1.0F;
00160     configInfo.depthStencilInfo.stencilTestEnable = VK_FALSE;
00161     configInfo.depthStencilInfo.front = {};
00162     configInfo.depthStencilInfo.back = {};
00163
00164     configInfo.dynamicStateEnables = {VK_DYNAMIC_STATE_VIEWPORT, VK_DYNAMIC_STATE_SCISSOR};
00165     configInfo.dynamicStateInfo.sType = VK_STRUCTURE_TYPE_PIPELINE_DYNAMIC_STATE_CREATE_INFO;
00166     configInfo.dynamicStateInfo.pDynamicStates = configInfo.dynamicStateEnables.data();
00167     configInfo.dynamicStateInfo.dynamicStateCount =
static_cast<uint32_t>(configInfo.dynamicStateEnables.size());
00168     configInfo.dynamicStateInfo.flags = 0;
00169     configInfo.bindingDescriptions = Model::Vertex::getBindingDescriptions();
00170     configInfo.attributeDescriptions = Model::Vertex::getAttributeDescriptions();
00171 }

```

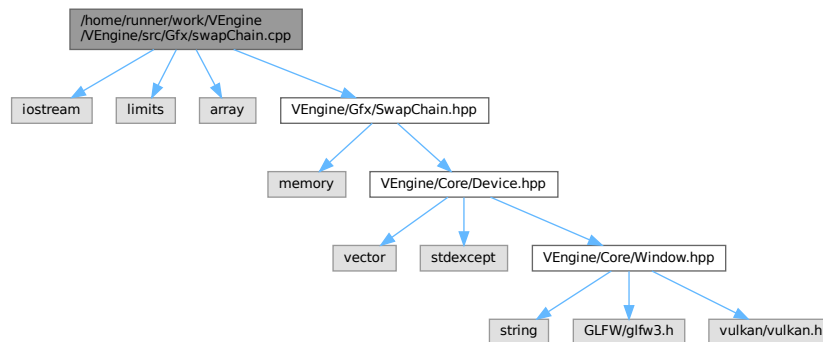
8.96 /home/runner/work/VEngine/VEngine/src/Gfx/swapChain.cpp File Reference

```

#include <iostream>
#include <limits>
#include <array>
#include "VEngine/Gfx/SwapChain.hpp"

```

Include dependency graph for swapChain.cpp:



8.97 swapChain.cpp

[Go to the documentation of this file.](#)

```

00001 #include <iostream>
00002 #include <limits>
00003 #include <array>
00004
00005 #include "VEngine/Gfx/SwapChain.hpp"
00006
00007 ven::SwapChain::~SwapChain()
00008 {
00009     for (VkImageView_T *imageView : m_swapChainImageViews) {
00010         vkDestroyImageView(m_device.device(), imageView, nullptr);
00011     }
00012     m_swapChainImageViews.clear();
00013
00014     if (m_swapChain != nullptr) {
00015         vkDestroySwapchainKHR(m_device.device(), m_swapChain, nullptr);
00016         m_swapChain = nullptr;
00017     }
00018
00019     for (size_t i = 0; i < m_depthImages.size(); i++) {
00020         vkDestroyImageView(m_device.device(), m_depthImageViews[i], nullptr);
00021         vkDestroyImage(m_device.device(), m_depthImages[i], nullptr);
00022         vkFreeMemory(m_device.device(), m_depthImageMemory[i], nullptr);
00023     }
00024
00025     for (VkFramebuffer_T *framebuffer : m_swapChainFrameBuffers) {
00026         vkDestroyFramebuffer(m_device.device(), framebuffer, nullptr);
00027     }
00028
00029     vkDestroyRenderPass(m_device.device(), m_renderPass, nullptr);
00030
00031     // cleanup synchronization objects
00032     for (size_t i = 0; i < MAX_FRAMES_IN_FLIGHT; i++) {
00033         vkDestroySemaphore(m_device.device(), m_renderFinishedSemaphores[i], nullptr);
00034         vkDestroySemaphore(m_device.device(), m_imageAvailableSemaphores[i], nullptr);
00035         vkDestroyFence(m_device.device(), m_inFlightFences[i], nullptr);
00036     }
00037 }
00038
00039 void ven::SwapChain::init()
00040 {
00041     createSwapChain();
00042     createImageViews();
00043     createRenderPass();
00044     createDepthResources();
00045     createFrameBuffers();
00046     createSyncObjects();
00047 }
00048
00049 VkResult ven::SwapChain::acquireNextImage(uint32_t *imageIndex) const
00050 {
00051     vkWaitForFences(m_device.device(), 1, &m_inFlightFences[m_currentFrame], VK_TRUE,
        std::numeric_limits<uint64_t>::max());

```

```

00052
00053     return vkAcquireNextImageKHR(m_device.device(), m_swapChain, std::numeric_limits<uint64_t>::max(),
00054     m_imageAvailableSemaphores[m_currentFrame], VK_NULL_HANDLE, imageIndex);
00055 }
00056 VkResult ven::SwapChain::submitCommandBuffers(const VkCommandBuffer *buffers, const uint32_t
00057 *imageIndex)
00058 {
00059     if (m_imagesInFlight[*imageIndex] != VK_NULL_HANDLE) {
00060         vkWaitForFences(m_device.device(), 1, &m_imagesInFlight[*imageIndex], VK_TRUE, UINT64_MAX);
00061     }
00062     m_imagesInFlight[*imageIndex] = m_inFlightFences[m_currentFrame];
00063     VkSubmitInfo submitInfo = {};
00064     submitInfo.sType = VK_STRUCTURE_TYPE_SUBMIT_INFO;
00065     const std::array<VkSemaphore, 1> waitSemaphores = {m_imageAvailableSemaphores[m_currentFrame]};
00066     constexpr std::array<VkPipelineStageFlags, 1> waitStages =
00067     {VK_PIPELINE_STAGE_COLOR_ATTACHMENT_OUTPUT_BIT};
00068     submitInfo.waitSemaphoreCount = 1;
00069     submitInfo.pWaitSemaphores = waitSemaphores.data();
00070     submitInfo.pWaitDstStageMask = waitStages.data();
00071     submitInfo.commandBufferCount = 1;
00072     submitInfo.pCommandBuffers = buffers;
00073     const std::array<VkSemaphore, 1> signalSemaphores = {m_renderFinishedSemaphores[m_currentFrame]};
00074     submitInfo.signalSemaphoreCount = 1;
00075     submitInfo.pSignalSemaphores = signalSemaphores.data();
00076     vkResetFences(m_device.device(), 1, &m_inFlightFences[m_currentFrame]);
00077     if (vkQueueSubmit(m_device.graphicsQueue(), 1, &submitInfo, m_inFlightFences[m_currentFrame]) !=
00078     VK_SUCCESS) {
00079         throw std::runtime_error("failed to submit draw command buffer!");
00080     }
00081     VkPresentInfoKHR presentInfo = {};
00082     presentInfo.sType = VK_STRUCTURE_TYPE_PRESENT_INFO_KHR;
00083     presentInfo.waitSemaphoreCount = 1;
00084     presentInfo.pWaitSemaphores = signalSemaphores.data();
00085     const std::array<VkSwapchainKHR, 1> swapChains = {m_swapChain};
00086     presentInfo.swapchainCount = 1;
00087     presentInfo.pSwapchains = swapChains.data();
00088     presentInfo.pImageIndices = imageIndex;
00089     const VkResult result = vkQueuePresentKHR(m_device.presentQueue(), &presentInfo);
00090     m_currentFrame = (m_currentFrame + 1) % MAX_FRAMES_IN_FLIGHT;
00091     return result;
00092 }
00093 void ven::SwapChain::createSwapChain()
00094 {
00095     const auto [capabilities, formats, presentModes] = m_device.getSwapChainSupport();
00096     const auto [format, colorSpace] = chooseSwapSurfaceFormat(formats);
00097     const VkPresentModeKHR presentMode = chooseSwapPresentMode(presentModes);
00098     const VkExtent2D extent = chooseSwapExtent(capabilities);
00099     uint32_t imageCount = capabilities.minImageCount + 1;
00100     if (capabilities.maxImageCount > 0 && imageCount > capabilities.maxImageCount) {
00101         imageCount = capabilities.maxImageCount;
00102     }
00103     VkSwapchainCreateInfoKHR createInfo = {};
00104     createInfo.sType = VK_STRUCTURE_TYPE_SWAPCHAIN_CREATE_INFO_KHR;
00105     createInfo.surface = m_device.surface();
00106     createInfo.minImageCount = imageCount;
00107     createInfo.imageFormat = format;
00108     createInfo.imageColorSpace = colorSpace;
00109     createInfo.imageExtent = extent;
00110     createInfo.imageArrayLayers = 1;
00111     createInfo.imageUsage = VK_IMAGE_USAGE_COLOR_ATTACHMENT_BIT;
00112     const auto [graphicsFamily, presentFamily, graphicsFamilyHasValue, presentFamilyHasValue] =
00113     m_device.findPhysicalQueueFamilies();
00114     const std::array<uint32_t, 2> queueFamilyIndices = {graphicsFamily, presentFamily};
00115     if (graphicsFamily != presentFamily) {
00116         createInfo.imageSharingMode = VK_SHARING_MODE_CONCURRENT;
00117         createInfo.queueFamilyIndexCount = 2;
00118         createInfo.pQueueFamilyIndices = queueFamilyIndices.data();
00119     }

```

```

00134     } else {
00135         createInfo.imageSharingMode = VK_SHARING_MODE_EXCLUSIVE;
00136         createInfo.queueFamilyIndexCount = 0; // Optional
00137         createInfo.pQueueFamilyIndices = nullptr; // Optional
00138     }
00139
00140     createInfo.preTransform = capabilities.currentTransform;
00141     createInfo.compositeAlpha = VK_COMPOSITE_ALPHA_OPAQUE_BIT_KHR;
00142
00143     createInfo.presentMode = presentMode;
00144     createInfo.clipped = VK_TRUE;
00145
00146     createInfo.oldSwapchain = m_oldSwapChain == nullptr ? VK_NULL_HANDLE :
m_oldSwapChain->m_swapChain;
00147
00148     if (vkCreateSwapchainKHR(m_device.device(), &createInfo, nullptr, &m_swapChain) != VK_SUCCESS) {
00149         throw std::runtime_error("failed to create swap chain!");
00150     }
00151
00152     vkGetSwapchainImagesKHR(m_device.device(), m_swapChain, &imageCount, nullptr);
00153     m_swapChainImages.resize(imageCount);
00154     vkGetSwapchainImagesKHR(m_device.device(), m_swapChain, &imageCount, m_swapChainImages.data());
00155
00156     m_swapChainImageFormat = format;
00157     m_swapChainExtent = extent;
00158 }
00159
00160 void ven::SwapChain::createImageViews()
00161 {
00162     m_swapChainImageViews.resize(m_swapChainImages.size());
00163     for (size_t i = 0; i < m_swapChainImages.size(); i++) {
00164         VkImageViewCreateInfo viewInfo{};
00165         viewInfo.sType = VK_STRUCTURE_TYPE_IMAGE_VIEW_CREATE_INFO;
00166         viewInfo.image = m_swapChainImages[i];
00167         viewInfo.viewType = VK_IMAGE_VIEW_TYPE_2D;
00168         viewInfo.format = m_swapChainImageFormat;
00169         viewInfo.subresourceRange.aspectMask = VK_IMAGE_ASPECT_COLOR_BIT;
00170         viewInfo.subresourceRange.baseMipLevel = 0;
00171         viewInfo.subresourceRange.levelCount = 1;
00172         viewInfo.subresourceRange.baseArrayLayer = 0;
00173         viewInfo.subresourceRange.layerCount = 1;
00174
00175         if (vkCreateImageView(m_device.device(), &viewInfo, nullptr, &m_swapChainImageViews[i]) !=
VK_SUCCESS) {
00176             throw std::runtime_error("failed to create texture image view!");
00177         }
00178     }
00179 }
00180
00181 void ven::SwapChain::createRenderPass()
00182 {
00183     VkAttachmentDescription depthAttachment{};
00184     depthAttachment.format = findDepthFormat();
00185     depthAttachment.samples = VK_SAMPLE_COUNT_1_BIT;
00186     depthAttachment.loadOp = VK_ATTACHMENT_LOAD_OP_CLEAR;
00187     depthAttachment.storeOp = VK_ATTACHMENT_STORE_OP_DONT_CARE;
00188     depthAttachment.stencilLoadOp = VK_ATTACHMENT_LOAD_OP_DONT_CARE;
00189     depthAttachment.stencilStoreOp = VK_ATTACHMENT_STORE_OP_DONT_CARE;
00190     depthAttachment.initialLayout = VK_IMAGE_LAYOUT_UNDEFINED;
00191     depthAttachment.finalLayout = VK_IMAGE_LAYOUT_DEPTH_STENCIL_ATTACHMENT_OPTIMAL;
00192
00193     VkAttachmentReference depthAttachmentRef{};
00194     depthAttachmentRef.attachment = 1;
00195     depthAttachmentRef.layout = VK_IMAGE_LAYOUT_DEPTH_STENCIL_ATTACHMENT_OPTIMAL;
00196
00197     VkAttachmentDescription colorAttachment = {};
00198     colorAttachment.format = getSwapChainImageFormat();
00199     colorAttachment.samples = VK_SAMPLE_COUNT_1_BIT;
00200     colorAttachment.loadOp = VK_ATTACHMENT_LOAD_OP_CLEAR;
00201     colorAttachment.storeOp = VK_ATTACHMENT_STORE_OP_STORE;
00202     colorAttachment.stencilStoreOp = VK_ATTACHMENT_STORE_OP_DONT_CARE;
00203     colorAttachment.stencilLoadOp = VK_ATTACHMENT_LOAD_OP_DONT_CARE;
00204     colorAttachment.initialLayout = VK_IMAGE_LAYOUT_UNDEFINED;
00205     colorAttachment.finalLayout = VK_IMAGE_LAYOUT_PRESENT_SRC_KHR;
00206
00207     VkAttachmentReference colorAttachmentRef = {};
00208     colorAttachmentRef.attachment = 0;
00209     colorAttachmentRef.layout = VK_IMAGE_LAYOUT_COLOR_ATTACHMENT_OPTIMAL;
00210
00211     VkSubpassDescription subpass = {};
00212     subpass.pipelineBindPoint = VK_PIPELINE_BIND_POINT_GRAPHICS;
00213     subpass.colorAttachmentCount = 1;
00214     subpass.pColorAttachments = &colorAttachmentRef;
00215     subpass.pDepthStencilAttachment = &depthAttachmentRef;
00216
00217     VkSubpassDependency dependency = {};
00218     dependency.srcSubpass = VK_SUBPASS_EXTERNAL;

```

```

00219     dependency.srcAccessMask = 0;
00220     dependency.srcStageMask = VK_PIPELINE_STAGE_COLOR_ATTACHMENT_OUTPUT_BIT |
VK_PIPELINE_STAGE_EARLY_FRAGMENT_TESTS_BIT;
00221     dependency.dstSubpass = 0;
00222     dependency.dstStageMask = VK_PIPELINE_STAGE_COLOR_ATTACHMENT_OUTPUT_BIT |
VK_PIPELINE_STAGE_EARLY_FRAGMENT_TESTS_BIT;
00223     dependency.dstAccessMask = VK_ACCESS_COLOR_ATTACHMENT_WRITE_BIT |
VK_ACCESS_DEPTH_STENCIL_ATTACHMENT_WRITE_BIT;
00224
00225     const std::array<VkAttachmentDescription, 2> attachments = {colorAttachment, depthAttachment};
00226     VkRenderPassCreateInfo renderPassInfo = {};
00227     renderPassInfo.sType = VK_STRUCTURE_TYPE_RENDER_PASS_CREATE_INFO;
00228     renderPassInfo.attachmentCount = static_cast<uint32_t>(attachments.size());
00229     renderPassInfo.pAttachments = attachments.data();
00230     renderPassInfo.subpassCount = 1;
00231     renderPassInfo.pSubpasses = &subpass;
00232     renderPassInfo.dependencyCount = 1;
00233     renderPassInfo.pDependencies = &dependency;
00234
00235     if (vkCreateRenderPass(m_device.device(), &renderPassInfo, nullptr, &m_renderPass) != VK_SUCCESS)
    {
00236         throw std::runtime_error("failed to create render pass!");
00237     }
00238 }
00239
00240 void ven::SwapChain::createFrameBuffers()
00241 {
00242     m_swapChainFrameBuffers.resize(imageCount());
00243     for (size_t i = 0; i < imageCount(); i++) {
00244         std::array<VkImageView, 2> attachments = {m_swapChainImageViews[i], m_depthImageViews[i]};
00245
00246         const auto [width, height] = getSwapChainExtent();
00247         VkFramebufferCreateInfo framebufferInfo = {};
00248         framebufferInfo.sType = VK_STRUCTURE_TYPE_FRAMEBUFFER_CREATE_INFO;
00249         framebufferInfo.renderPass = m_renderPass;
00250         framebufferInfo.attachmentCount = static_cast<uint32_t>(attachments.size());
00251         framebufferInfo.pAttachments = attachments.data();
00252         framebufferInfo.width = width;
00253         framebufferInfo.height = height;
00254         framebufferInfo.layers = 1;
00255
00256         if (vkCreateFramebuffer(m_device.device(), &framebufferInfo, nullptr,
&m_swapChainFrameBuffers[i]) != VK_SUCCESS) {
00257             throw std::runtime_error("failed to create framebuffer!");
00258         }
00259     }
00260 }
00261
00262 void ven::SwapChain::createDepthResources()
00263 {
00264     const VkFormat depthFormat = findDepthFormat();
00265     const auto [width, height] = getSwapChainExtent();
00266
00267     m_swapChainDepthFormat = depthFormat;
00268     m_depthImages.resize(imageCount());
00269     m_depthImageMemory.resize(imageCount());
00270     m_depthImageViews.resize(imageCount());
00271
00272     for (size_t i = 0; i < m_depthImages.size(); i++) {
00273         VkImageCreateInfo imageInfo{};
00274         imageInfo.sType = VK_STRUCTURE_TYPE_IMAGE_CREATE_INFO;
00275         imageInfo.imageType = VK_IMAGE_TYPE_2D;
00276         imageInfo.extent.width = width;
00277         imageInfo.extent.height = height;
00278         imageInfo.extent.depth = 1;
00279         imageInfo.mipLevels = 1;
00280         imageInfo.arrayLayers = 1;
00281         imageInfo.format = depthFormat;
00282         imageInfo.tiling = VK_IMAGE_TILING_OPTIMAL;
00283         imageInfo.initialLayout = VK_IMAGE_LAYOUT_UNDEFINED;
00284         imageInfo.usage = VK_IMAGE_USAGE_DEPTH_STENCIL_ATTACHMENT_BIT;
00285         imageInfo.samples = VK_SAMPLE_COUNT_1_BIT;
00286         imageInfo.sharingMode = VK_SHARING_MODE_EXCLUSIVE;
00287         imageInfo.flags = 0;
00288
00289         m_device.createImageWithInfo(imageInfo, VK_MEMORY_PROPERTY_DEVICE_LOCAL_BIT, m_depthImages[i],
m_depthImageMemory[i]);
00290
00291         VkImageViewCreateInfo viewInfo{};
00292         viewInfo.sType = VK_STRUCTURE_TYPE_IMAGE_VIEW_CREATE_INFO;
00293         viewInfo.image = m_depthImages[i];
00294         viewInfo.viewType = VK_IMAGE_VIEW_TYPE_2D;
00295         viewInfo.format = depthFormat;
00296         viewInfo.subresourceRange.aspectMask = VK_IMAGE_ASPECT_DEPTH_BIT;
00297         viewInfo.subresourceRange.baseMipLevel = 0;
00298         viewInfo.subresourceRange.levelCount = 1;
00299         viewInfo.subresourceRange.baseArrayLayer = 0;

```



```

00300         viewInfo.subresourceRange.layerCount = 1;
00301
00302         if (vkCreateImageView(m_device.device(), &viewInfo, nullptr, &m_depthImageViews[i]) !=
VK_SUCCESS) {
00303             throw std::runtime_error("failed to create texture image view!");
00304         }
00305     }
00306 }
00307
00308 void ven::SwapChain::createSyncObjects()
00309 {
00310     m_imageAvailableSemaphores.resize(MAX_FRAMES_IN_FLIGHT);
00311     m_renderFinishedSemaphores.resize(MAX_FRAMES_IN_FLIGHT);
00312     m_inFlightFences.resize(MAX_FRAMES_IN_FLIGHT);
00313     m_imagesInFlight.resize(imageCount(), VK_NULL_HANDLE);
00314
00315     VkSemaphoreCreateInfo semaphoreInfo = {};
00316     semaphoreInfo.sType = VK_STRUCTURE_TYPE_SEMAPHORE_CREATE_INFO;
00317
00318     VkFenceCreateInfo fenceInfo = {};
00319     fenceInfo.sType = VK_STRUCTURE_TYPE_FENCE_CREATE_INFO;
00320     fenceInfo.flags = VK_FENCE_CREATE_SIGNALED_BIT;
00321
00322     for (size_t i = 0; i < MAX_FRAMES_IN_FLIGHT; i++) {
00323         if (vkCreateSemaphore(m_device.device(), &semaphoreInfo, nullptr,
&m_imageAvailableSemaphores[i]) != VK_SUCCESS ||
00324             vkCreateSemaphore(m_device.device(), &semaphoreInfo, nullptr,
&m_renderFinishedSemaphores[i]) != VK_SUCCESS ||
00325             vkCreateFence(m_device.device(), &fenceInfo, nullptr, &m_inFlightFences[i]) != VK_SUCCESS)
00326         {
00327             throw std::runtime_error("failed to create synchronization objects for a frame!");
00328         }
00329     }
00330 }
00331 VkSurfaceFormatKHR ven::SwapChain::chooseSwapSurfaceFormat(const std::vector<VkSurfaceFormatKHR>
&availableFormats)
00332 {
00333     for (const auto &availableFormat : availableFormats) {
00334         if (availableFormat.format == VK_FORMAT_B8G8R8A8_UNORM && availableFormat.colorSpace ==
VK_COLOR_SPACE_SRGB_NONLINEAR_KHR) {
00335             return availableFormat;
00336         }
00337     }
00338     return availableFormats[0];
00339 }
00340 }
00341
00342 VkPresentModeKHR ven::SwapChain::chooseSwapPresentMode(const std::vector<VkPresentModeKHR>
&availablePresentModes)
00343 {
00344     for (const auto &availablePresentMode : availablePresentModes) {
00345         if (availablePresentMode == VK_PRESENT_MODE_MAILBOX_KHR) {
00346             std::cout << "Present mode: Mailbox\n";
00347             return availablePresentMode;
00348         }
00349     }
00350
00351     for (const auto &availablePresentMode : availablePresentModes) {
00352         if (availablePresentMode == VK_PRESENT_MODE_IMMEDIATE_KHR) {
00353             std::cout << "Present mode: Immediate" << '\n';
00354             return availablePresentMode;
00355         }
00356     }
00357
00358     std::cout << "Present mode: V-Sync\n";
00359     return VK_PRESENT_MODE_FIFO_KHR;
00360 }
00361
00362 VkExtent2D ven::SwapChain::chooseSwapExtent(const VkSurfaceCapabilitiesKHR &capabilities) const
00363 {
00364     if (capabilities.currentExtent.width != std::numeric_limits<uint32_t>::max()) {
00365         return capabilities.currentExtent;
00366     }
00367     VkExtent2D actualExtent = m_windowExtent;
00368     actualExtent.width = std::max(capabilities.minImageExtent.width,
std::min(capabilities.maxImageExtent.width, actualExtent.width));
00369     actualExtent.height = std::max(capabilities.minImageExtent.height,
std::min(capabilities.maxImageExtent.height, actualExtent.height));
00370
00371     return actualExtent;
00372 }
00373
00374 VkFormat ven::SwapChain::findDepthFormat() const
00375 {
00376     return m_device.findSupportedFormat(
{VK_FORMAT_D32_SFLOAT, VK_FORMAT_D32_SFLOAT_S8_UINT, VK_FORMAT_D24_UNORM_S8_UINT},
00377

```

```

00378         VK_IMAGE_TILING_OPTIMAL,
00379         VK_FORMAT_FEATURE_DEPTH_STENCIL_ATTACHMENT_BIT);
00380     }

```

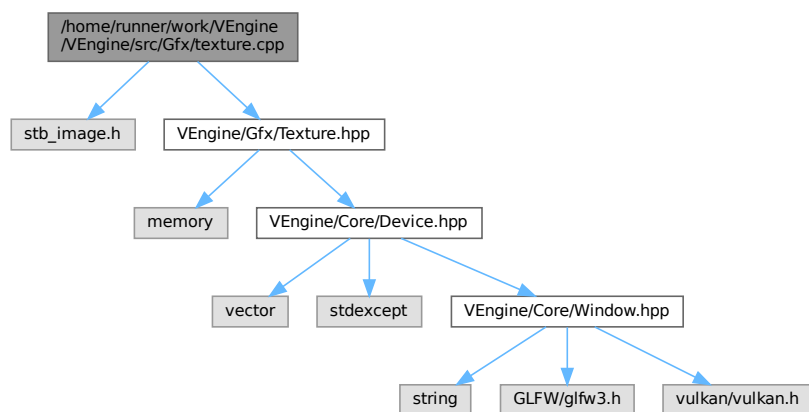
8.98 /home/runner/work/VEngine/VEngine/src/Gfx/texture.cpp File Reference

```

#include <stb_image.h>
#include "VEngine/Gfx/Texture.hpp"

```

Include dependency graph for texture.cpp:



Macros

- `#define` [STB_IMAGE_IMPLEMENTATION](#)

8.98.1 Macro Definition Documentation

8.98.1.1 STB_IMAGE_IMPLEMENTATION

```
#define STB_IMAGE_IMPLEMENTATION
```

Definition at line 1 of file [texture.cpp](#).

8.99 texture.cpp

[Go to the documentation of this file.](#)

```

00001 #define STB_IMAGE_IMPLEMENTATION
00002 #include <stb_image.h>
00003
00004 #include "VEngine/Gfx/Texture.hpp"
00005
00006 ven::Texture::Texture(Device &device, const std::string &textureFilepath) : m_device{device}
00007 {

```

```

00008     createTextureImage(textureFilepath);
00009     createTextureImageView(VK_IMAGE_VIEW_TYPE_2D);
00010     createTextureSampler();
00011     updateDescriptor();
00012 }
00013
00014 ven::Texture::Texture(Device &device, VkFormat format, VkExtent3D extent, VkImageUsageFlags usage,
    VkSampleCountFlagBits sampleCount)
00015 : m_device(device), m_format(format), m_extent(extent)
00016 {
00017     VkImageAspectFlags aspectMask = 0;
00018     VkImageLayout imageLayout;
00019
00020     if ((usage & VK_IMAGE_USAGE_COLOR_ATTACHMENT_BIT) != 0u) {
00021         aspectMask = VK_IMAGE_ASPECT_COLOR_BIT;
00022         imageLayout = VK_IMAGE_LAYOUT_COLOR_ATTACHMENT_OPTIMAL;
00023     }
00024     if ((usage & VK_IMAGE_USAGE_DEPTH_STENCIL_ATTACHMENT_BIT) != 0u) {
00025         aspectMask = VK_IMAGE_ASPECT_DEPTH_BIT;
00026         imageLayout = VK_IMAGE_LAYOUT_DEPTH_STENCIL_ATTACHMENT_OPTIMAL;
00027     }
00028
00029     // Don't like this, should I be using an image array instead of multiple images?
00030     VkImageCreateInfo imageInfo{};
00031     imageInfo.sType = VK_STRUCTURE_TYPE_IMAGE_CREATE_INFO;
00032     imageInfo.imageType = VK_IMAGE_TYPE_2D;
00033     imageInfo.format = format;
00034     imageInfo.extent = extent;
00035     imageInfo.mipLevels = 1;
00036     imageInfo.arrayLayers = 1;
00037     imageInfo.samples = sampleCount;
00038     imageInfo.tiling = VK_IMAGE_TILING_OPTIMAL;
00039     imageInfo.usage = usage;
00040     imageInfo.initialLayout = VK_IMAGE_LAYOUT_UNDEFINED;
00041     device.createImageWithInfo(imageInfo, VK_MEMORY_PROPERTY_DEVICE_LOCAL_BIT, m_textureImage,
    m_textureImageMemory);
00042
00043     VkImageViewCreateInfo viewInfo{};
00044     viewInfo.sType = VK_STRUCTURE_TYPE_IMAGE_VIEW_CREATE_INFO;
00045     viewInfo.viewType = VK_IMAGE_VIEW_TYPE_2D;
00046     viewInfo.format = format;
00047     viewInfo.subresourceRange = {};
00048     viewInfo.subresourceRange.aspectMask = aspectMask;
00049     viewInfo.subresourceRange.baseMipLevel = 0;
00050     viewInfo.subresourceRange.levelCount = 1;
00051     viewInfo.subresourceRange.baseArrayLayer = 0;
00052     viewInfo.subresourceRange.layerCount = 1;
00053     viewInfo.image = m_textureImage;
00054     if (vkCreateImageView(device.device(), &viewInfo, nullptr, &m_textureImageView) != VK_SUCCESS) {
00055         throw std::runtime_error("failed to create texture image view!");
00056     }
00057
00058     // Sampler should be seperated out
00059     if ((usage & VK_IMAGE_USAGE_SAMPLED_BIT) != 0U) {
00060         // Create sampler to sample from the attachment in the fragment shader
00061         VkSamplerCreateInfo samplerInfo{};
00062         samplerInfo.sType = VK_STRUCTURE_TYPE_SAMPLER_CREATE_INFO;
00063         samplerInfo.magFilter = VK_FILTER_LINEAR;
00064         samplerInfo.minFilter = VK_FILTER_LINEAR;
00065         samplerInfo.mipmapMode = VK_SAMPLER_MIPMAP_MODE_LINEAR;
00066         samplerInfo.addressModeU = VK_SAMPLER_ADDRESS_MODE_CLAMP_TO_BORDER;
00067         samplerInfo.addressModeV = samplerInfo.addressModeU;
00068         samplerInfo.addressModeW = samplerInfo.addressModeU;
00069         samplerInfo.mipLodBias = 0.0F;
00070         samplerInfo.maxAnisotropy = 1.0F;
00071         samplerInfo.minLod = 0.0F;
00072         samplerInfo.maxLod = 1.0F;
00073         samplerInfo.borderColor = VK_BORDER_COLOR_FLOAT_OPAQUE_BLACK;
00074
00075         if (vkCreateSampler(device.device(), &samplerInfo, nullptr, &m_textureSampler) != VK_SUCCESS)
00076         {
00077             throw std::runtime_error("failed to create sampler!");
00078         }
00079
00080         VkImageLayout samplerImageLayout = imageLayout == VK_IMAGE_LAYOUT_COLOR_ATTACHMENT_OPTIMAL
            ? VK_IMAGE_LAYOUT_SHADER_READ_ONLY_OPTIMAL
            : VK_IMAGE_LAYOUT_DEPTH_STENCIL_READ_ONLY_OPTIMAL;
00081         m_descriptor.sampler = m_textureSampler;
00082         m_descriptor.imageView = m_textureImageView;
00083         m_descriptor.imageLayout = samplerImageLayout;
00084     }
00085 }
00086
00087
00088 ven::Texture::~Texture()
00089 {
00090     vkDestroySampler(m_device.device(), m_textureSampler, nullptr);
00091     vkDestroyImageView(m_device.device(), m_textureImageView, nullptr);

```

```

00092     vkDestroyImage(m_device.device(), m_textureImage, nullptr);
00093     vkFreeMemory(m_device.device(), m_textureImageMemory, nullptr);
00094 }
00095
00096 void ven::Texture::updateDescriptor()
00097 {
00098     m_descriptor.sampler = m_textureSampler;
00099     m_descriptor.imageView = m_textureImageView;
00100     m_descriptor.imageLayout = m_textureLayout;
00101 }
00102
00103 void ven::Texture::createTextureImage(const std::string &filepath)
00104 {
00105     int texWidth = 0;
00106     int texHeight = 0;
00107     int texChannels = 0;
00108     void *data = nullptr;
00109     stbi_uc *pixels = nullptr;
00110
00111     stbi_set_flip_vertically_on_load(1);
00112     pixels = stbi_load(filepath.c_str(), &texWidth, &texHeight, &texChannels, STBI_rgb_alpha);
00113     const auto imageSize = static_cast<VkDeviceSize>(texWidth * texHeight * 4);
00114
00115     if (pixels == nullptr) {
00116         throw std::runtime_error("failed to load texture image!");
00117     }
00118
00119     // mMipLevels = static_cast<uint32_t>(std::floor(std::log2(std::max(texWidth, texHeight)))) + 1;
00120     m_mipLevels = 1;
00121
00122     VkBuffer stagingBuffer = nullptr;
00123     VkDeviceMemory stagingBufferMemory = nullptr;
00124
00125     m_device.createBuffer(
00126         imageSize,
00127         VK_BUFFER_USAGE_TRANSFER_SRC_BIT,
00128         VK_MEMORY_PROPERTY_HOST_VISIBLE_BIT | VK_MEMORY_PROPERTY_HOST_COHERENT_BIT,
00129         stagingBuffer,
00130         stagingBufferMemory);
00131
00132     vkMapMemory(m_device.device(), stagingBufferMemory, 0, imageSize, 0, &data);
00133     memcpy(data, pixels, imageSize);
00134     vkUnmapMemory(m_device.device(), stagingBufferMemory);
00135
00136     stbi_image_free(pixels);
00137
00138     m_format = VK_FORMAT_R8G8B8A8_SRGB;
00139     m_extent = {.width=static_cast<uint32_t>(texWidth), .height=static_cast<uint32_t>(texHeight),
    .depth=1};
00140
00141     VkImageCreateInfo imageInfo{};
00142     imageInfo.sType = VK_STRUCTURE_TYPE_IMAGE_CREATE_INFO;
00143     imageInfo.imageType = VK_IMAGE_TYPE_2D;
00144     imageInfo.extent = m_extent;
00145     imageInfo.mipLevels = m_mipLevels;
00146     imageInfo.arrayLayers = m_layerCount;
00147     imageInfo.format = m_format;
00148     imageInfo.tiling = VK_IMAGE_TILING_OPTIMAL;
00149     imageInfo.initialLayout = VK_IMAGE_LAYOUT_UNDEFINED;
00150     imageInfo.usage = VK_IMAGE_USAGE_TRANSFER_SRC_BIT | VK_IMAGE_USAGE_TRANSFER_DST_BIT |
    VK_IMAGE_USAGE_SAMPLED_BIT;
00151     imageInfo.samples = VK_SAMPLE_COUNT_1_BIT;
00152     imageInfo.sharingMode = VK_SHARING_MODE_EXCLUSIVE;
00153
00154     m_device.createImageWithInfo(
00155         imageInfo,
00156         VK_MEMORY_PROPERTY_DEVICE_LOCAL_BIT,
00157         m_textureImage,
00158         m_textureImageMemory);
00159     m_device.transitionImageLayout(
00160         m_textureImage,
00161         VK_FORMAT_R8G8B8A8_SRGB,
00162         VK_IMAGE_LAYOUT_UNDEFINED,
00163         VK_IMAGE_LAYOUT_TRANSFER_DST_OPTIMAL,
00164         m_mipLevels,
00165         m_layerCount);
00166     m_device.copyBufferToImage(
00167         stagingBuffer,
00168         m_textureImage,
00169         static_cast<uint32_t>(texWidth),
00170         static_cast<uint32_t>(texHeight),
00171         m_layerCount);
00172
00173     // comment this out if using mips
00174     m_device.transitionImageLayout(
00175         m_textureImage,
00176         VK_FORMAT_R8G8B8A8_SRGB,

```

```

00177         VK_IMAGE_LAYOUT_TRANSFER_DST_OPTIMAL,
00178         VK_IMAGE_LAYOUT_SHADER_READ_ONLY_OPTIMAL,
00179         m_mipLevels,
00180         m_layerCount);
00181
00182         // If we generate mip maps then the final image will already be READ_ONLY_OPTIMAL
00183         // mDevice.generateMipmaps(mTextureImage, mFormat, texWidth, texHeight, mMipLevels);
00184         m_textureLayout = VK_IMAGE_LAYOUT_SHADER_READ_ONLY_OPTIMAL;
00185
00186         vkDestroyBuffer(m_device.device(), stagingBuffer, nullptr);
00187         vkFreeMemory(m_device.device(), stagingBufferMemory, nullptr);
00188     }
00189
00190     void ven::Texture::createTextureImageView(const VkImageViewType viewType)
00191     {
00192         VkImageViewCreateInfo viewInfo{};
00193         viewInfo.sType = VK_STRUCTURE_TYPE_IMAGE_VIEW_CREATE_INFO;
00194         viewInfo.image = m_textureImage;
00195         viewInfo.viewType = viewType;
00196         viewInfo.format = VK_FORMAT_R8G8B8A8_SRGB;
00197         viewInfo.subresourceRange.aspectMask = VK_IMAGE_ASPECT_COLOR_BIT;
00198         viewInfo.subresourceRange.baseMipLevel = 0;
00199         viewInfo.subresourceRange.levelCount = m_mipLevels;
00200         viewInfo.subresourceRange.baseArrayLayer = 0;
00201         viewInfo.subresourceRange.layerCount = m_layerCount;
00202
00203         if (vkCreateImageView(m_device.device(), &viewInfo, nullptr, &m_textureImageView) != VK_SUCCESS) {
00204             throw std::runtime_error("failed to create texture image view!");
00205         }
00206     }
00207
00208     void ven::Texture::createTextureSampler()
00209     {
00210         VkSamplerCreateInfo samplerInfo{};
00211         samplerInfo.sType = VK_STRUCTURE_TYPE_SAMPLER_CREATE_INFO;
00212         samplerInfo.magFilter = VK_FILTER_LINEAR;
00213         samplerInfo.minFilter = VK_FILTER_LINEAR;
00214
00215         samplerInfo.addressModeU = VK_SAMPLER_ADDRESS_MODE_REPEAT;
00216         samplerInfo.addressModeV = VK_SAMPLER_ADDRESS_MODE_REPEAT;
00217         samplerInfo.addressModeW = VK_SAMPLER_ADDRESS_MODE_REPEAT;
00218
00219         samplerInfo.anisotropyEnable = VK_TRUE;
00220         samplerInfo.maxAnisotropy = 16.0F;
00221         samplerInfo.borderColor = VK_BORDER_COLOR_INT_OPAQUE_BLACK;
00222         samplerInfo.unnormalizedCoordinates = VK_FALSE;
00223
00224         // these fields useful for percentage close filtering for shadow maps
00225         samplerInfo.compareEnable = VK_FALSE;
00226         samplerInfo.compareOp = VK_COMPARE_OP_ALWAYS;
00227
00228         samplerInfo.mipmapMode = VK_SAMPLER_MIPMAP_MODE_LINEAR;
00229         samplerInfo.mipLodBias = 0.0F;
00230         samplerInfo.minLod = 0.0F;
00231         samplerInfo.maxLod = static_cast<float>(m_mipLevels);
00232
00233         if (vkCreateSampler(m_device.device(), &samplerInfo, nullptr, &m_textureSampler) != VK_SUCCESS) {
00234             throw std::runtime_error("failed to create texture sampler!");
00235         }
00236     }
00237
00238     void ven::Texture::transitionLayout(const VkCommandBuffer commandBuffer, const VkImageLayout
oldLayout, const VkImageLayout newLayout) const
00239     {
00240         VkPipelineStageFlags sourceStage = 0;
00241         VkPipelineStageFlags destinationStage = 0;
00242         VkImageMemoryBarrier barrier{};
00243
00244         barrier.sType = VK_STRUCTURE_TYPE_IMAGE_MEMORY_BARRIER;
00245         barrier.oldLayout = oldLayout;
00246         barrier.newLayout = newLayout;
00247
00248         barrier.srcQueueFamilyIndex = VK_QUEUE_FAMILY_IGNORED;
00249         barrier.dstQueueFamilyIndex = VK_QUEUE_FAMILY_IGNORED;
00250
00251         barrier.image = m_textureImage;
00252         barrier.subresourceRange.baseMipLevel = 0;
00253         barrier.subresourceRange.levelCount = m_mipLevels;
00254         barrier.subresourceRange.baseArrayLayer = 0;
00255         barrier.subresourceRange.layerCount = m_layerCount;
00256
00257         if (newLayout == VK_IMAGE_LAYOUT_DEPTH_STENCIL_ATTACHMENT_OPTIMAL) {
00258             barrier.subresourceRange.aspectMask = VK_IMAGE_ASPECT_DEPTH_BIT;
00259             if (m_format == VK_FORMAT_D32_SFLOAT_S8_UINT || m_format == VK_FORMAT_D24_UNORM_S8_UINT) {
00260                 barrier.subresourceRange.aspectMask |= VK_IMAGE_ASPECT_STENCIL_BIT;
00261             }
00262         } else {

```

```

00263     barrier.subresourceRange.aspectMask = VK_IMAGE_ASPECT_COLOR_BIT;
00264 }
00265 if (oldLayout == VK_IMAGE_LAYOUT_UNDEFINED && newLayout == VK_IMAGE_LAYOUT_TRANSFER_DST_OPTIMAL) {
00266     barrier.srcAccessMask = 0;
00267     barrier.dstAccessMask = VK_ACCESS_TRANSFER_WRITE_BIT;
00268     sourceStage = VK_PIPELINE_STAGE_TOP_OF_PIPE_BIT;
00269     destinationStage = VK_PIPELINE_STAGE_TRANSFER_BIT;
00270 } else if (oldLayout == VK_IMAGE_LAYOUT_UNDEFINED && newLayout ==
VK_IMAGE_LAYOUT_TRANSFER_SRC_OPTIMAL) {
00271     barrier.srcAccessMask = 0;
00272     barrier.dstAccessMask = VK_ACCESS_TRANSFER_WRITE_BIT;
00273     sourceStage = VK_PIPELINE_STAGE_TOP_OF_PIPE_BIT;
00274     destinationStage = VK_PIPELINE_STAGE_TRANSFER_BIT;
00275 } else if (oldLayout == VK_IMAGE_LAYOUT_TRANSFER_DST_OPTIMAL && newLayout ==
VK_IMAGE_LAYOUT_SHADER_READ_ONLY_OPTIMAL) {
00276     barrier.srcAccessMask = VK_ACCESS_TRANSFER_WRITE_BIT;
00277     barrier.dstAccessMask = VK_ACCESS_SHADER_READ_BIT;
00278
00279     sourceStage = VK_PIPELINE_STAGE_TRANSFER_BIT;
00280     destinationStage = VK_PIPELINE_STAGE_FRAGMENT_SHADER_BIT;
00281 } else if (oldLayout == VK_IMAGE_LAYOUT_UNDEFINED && newLayout ==
VK_IMAGE_LAYOUT_DEPTH_STENCIL_ATTACHMENT_OPTIMAL) {
00282     barrier.srcAccessMask = 0;
00283     barrier.dstAccessMask = VK_ACCESS_DEPTH_STENCIL_ATTACHMENT_READ_BIT |
VK_ACCESS_DEPTH_STENCIL_ATTACHMENT_WRITE_BIT;
00284     sourceStage = VK_PIPELINE_STAGE_TOP_OF_PIPE_BIT;
00285     destinationStage = VK_PIPELINE_STAGE_EARLY_FRAGMENT_TESTS_BIT;
00286 } else if (oldLayout == VK_IMAGE_LAYOUT_SHADER_READ_ONLY_OPTIMAL && newLayout ==
VK_IMAGE_LAYOUT_COLOR_ATTACHMENT_OPTIMAL) {
00287     // This says that any cmd that acts in color output or after (dstStage)
00288     // that needs read or write access to a resource
00289     // must wait until all previous read accesses in fragment shader
00290     barrier.srcAccessMask = VK_ACCESS_SHADER_READ_BIT | VK_ACCESS_SHADER_WRITE_BIT;
00291     barrier.dstAccessMask = VK_ACCESS_COLOR_ATTACHMENT_WRITE_BIT |
VK_ACCESS_COLOR_ATTACHMENT_READ_BIT;
00292     sourceStage = VK_PIPELINE_STAGE_FRAGMENT_SHADER_BIT;
00293     destinationStage = VK_PIPELINE_STAGE_COLOR_ATTACHMENT_OUTPUT_BIT;
00294 } else {
00295     throw std::invalid_argument("unsupported layout transition!");
00296 }
00297 vkCmdPipelineBarrier(commandBuffer, sourceStage, destinationStage, 0, 0, nullptr, 0, nullptr, 1,
&barrier);
00298 }

```

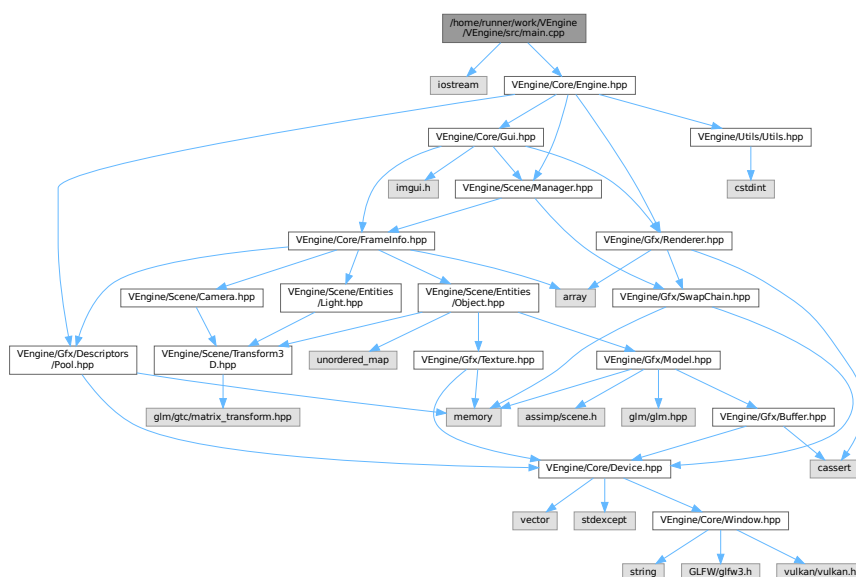
8.100 /home/runner/work/VEngine/VEngine/src/main.cpp File Reference

```

#include <iostream>
#include "VEngine/Core/Engine.hpp"

```

Include dependency graph for main.cpp:



Functions

- int [main](#) ()

8.100.1 Function Documentation

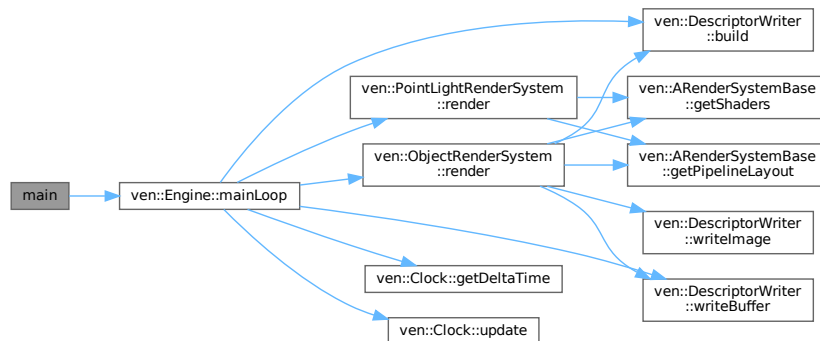
8.100.1.1 main()

```
int main ()
```

Definition at line 7 of file [main.cpp](#).

References [ven::Engine::mainLoop\(\)](#).

Here is the call graph for this function:



8.101 main.cpp

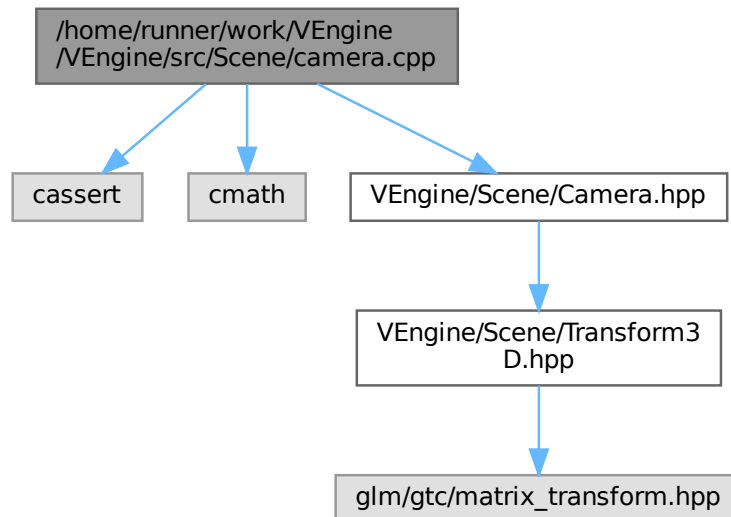
[Go to the documentation of this file.](#)

```

00001 #include <iostream>
00002
00003 #include "VEngine/Core/Engine.hpp"
00004
00005 using namespace ven;
00006
00007 int main()
00008 {
00009     try {
00010         Engine engine{};
00011         engine.mainLoop();
00012         engine.cleanup();
00013     } catch (const std::exception &e) {
00014         std::cerr << "std exception: " << e.what() << '\n';
00015         return EXIT_FAILURE;
00016     } catch (...) {
00017         std::cerr << "Unknown error\n";
00018         return EXIT_SUCCESS;
00019     }
00020     return EXIT_SUCCESS;
00021 }
```

8.102 /home/runner/work/VEngine/VEngine/src/Scene/camera.cpp File Reference

```
#include <cassert>
#include <cmath>
#include "VEngine/Scene/Camera.hpp"
Include dependency graph for camera.cpp:
```



8.103 camera.cpp

[Go to the documentation of this file.](#)

```
00001 #include <cassert>
00002 #include <cmath>
00003
00004 #include "VEngine/Scene/Camera.hpp"
00005
00006 void ven::Camera::setOrthographicProjection(const float left, const float right, const float top,
00007     const float bottom, const float near, const float far)
00008 {
00009     m_projectionMatrix = glm::mat4{1.0F};
00010     m_projectionMatrix[0][0] = 2.F / (right - left);
00011     m_projectionMatrix[1][1] = 2.F / (top - bottom);
00012     m_projectionMatrix[2][2] = 1.F / (far - near);
00013     m_projectionMatrix[3][0] = -(right + left) / (right - left);
00014     m_projectionMatrix[3][1] = -(bottom + top) / (top - bottom);
00015     m_projectionMatrix[3][2] = -near / (far - near);
00016 }
00017 void ven::Camera::setPerspectiveProjection(const float aspect)
00018 {
00019     assert(glm::abs(aspect - std::numeric_limits<float>::epsilon()) > 0.0F);
00020     const float tanHalfFov = std::tan(m_fov / 2.F);
00021     m_projectionMatrix = glm::mat4{0.0F};
00022     m_projectionMatrix[0][0] = 1.F / (aspect * tanHalfFov);
00023     m_projectionMatrix[1][1] = 1.F / (tanHalfFov);
00024     m_projectionMatrix[2][2] = m_far / (m_far - m_near);
00025     m_projectionMatrix[2][3] = 1.F;
00026     m_projectionMatrix[3][2] = -(m_far * m_near) / (m_far - m_near);
00027 }
```



```

00028
00029 void ven::Camera::setViewDirection(const glm::vec3 position, const glm::vec3 direction, const
    glm::vec3 up)
00030 {
00031     const glm::vec3 w(normalize(direction));
00032     const glm::vec3 u(normalize(cross(w, up)));
00033     const glm::vec3 v(cross(w, u));
00034
00035     m_viewMatrix = glm::mat4(1.F);
00036     m_viewMatrix[0][0] = u.x;
00037     m_viewMatrix[1][0] = u.y;
00038     m_viewMatrix[2][0] = u.z;
00039     m_viewMatrix[0][1] = v.x;
00040     m_viewMatrix[1][1] = v.y;
00041     m_viewMatrix[2][1] = v.z;
00042     m_viewMatrix[0][2] = w.x;
00043     m_viewMatrix[1][2] = w.y;
00044     m_viewMatrix[2][2] = w.z;
00045     m_viewMatrix[3][0] = -dot(u, position);
00046     m_viewMatrix[3][1] = -dot(v, position);
00047     m_viewMatrix[3][2] = -dot(w, position);
00048
00049     m_inverseViewMatrix = glm::mat4(1.F);
00050     m_inverseViewMatrix[0][0] = u.x;
00051     m_inverseViewMatrix[0][1] = u.y;
00052     m_inverseViewMatrix[0][2] = u.z;
00053     m_inverseViewMatrix[1][0] = v.x;
00054     m_inverseViewMatrix[1][1] = v.y;
00055     m_inverseViewMatrix[1][2] = v.z;
00056     m_inverseViewMatrix[2][0] = w.x;
00057     m_inverseViewMatrix[2][1] = w.y;
00058     m_inverseViewMatrix[2][2] = w.z;
00059     m_inverseViewMatrix[3][0] = position.x;
00060     m_inverseViewMatrix[3][1] = position.y;
00061     m_inverseViewMatrix[3][2] = position.z;
00062 }
00063
00064 void ven::Camera::setViewXYZ(const glm::vec3 position, const glm::vec3 rotation)
00065 {
00066     const float c3 = glm::cos(rotation.z);
00067     const float s3 = glm::sin(rotation.z);
00068     const float c2 = glm::cos(rotation.x);
00069     const float s2 = glm::sin(rotation.x);
00070     const float c1 = glm::cos(rotation.y);
00071     const float s1 = glm::sin(rotation.y);
00072     const glm::vec3 u{(c1 * c3 + s1 * s2 * s3), (c2 * s3), (c1 * s2 * s3 - c3 * s1)};
00073     const glm::vec3 v{(c3 * s1 * s2 - c1 * s3), (c2 * c3), (c1 * c3 * s2 + s1 * s3)};
00074     const glm::vec3 w{(c2 * s1), (-s2), (c1 * c2)};
00075     m_viewMatrix = glm::mat4(1.F);
00076     m_viewMatrix[0][0] = u.x;
00077     m_viewMatrix[1][0] = u.y;
00078     m_viewMatrix[2][0] = u.z;
00079     m_viewMatrix[0][1] = v.x;
00080     m_viewMatrix[1][1] = v.y;
00081     m_viewMatrix[2][1] = v.z;
00082     m_viewMatrix[0][2] = w.x;
00083     m_viewMatrix[1][2] = w.y;
00084     m_viewMatrix[2][2] = w.z;
00085     m_viewMatrix[3][0] = -dot(u, position);
00086     m_viewMatrix[3][1] = -dot(v, position);
00087     m_viewMatrix[3][2] = -dot(w, position);
00088
00089     m_inverseViewMatrix = glm::mat4(1.F);
00090     m_inverseViewMatrix[0][0] = u.x;
00091     m_inverseViewMatrix[0][1] = u.y;
00092     m_inverseViewMatrix[0][2] = u.z;
00093     m_inverseViewMatrix[1][0] = v.x;
00094     m_inverseViewMatrix[1][1] = v.y;
00095     m_inverseViewMatrix[1][2] = v.z;
00096     m_inverseViewMatrix[2][0] = w.x;
00097     m_inverseViewMatrix[2][1] = w.y;
00098     m_inverseViewMatrix[2][2] = w.z;
00099     m_inverseViewMatrix[3][0] = position.x;
00100     m_inverseViewMatrix[3][1] = position.y;
00101     m_inverseViewMatrix[3][2] = position.z;
00102 }

```



```

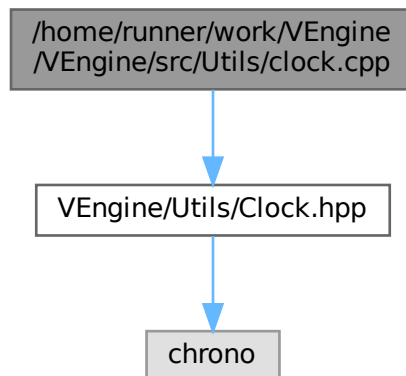
00038     const Object &cpyObj = m_objects.at(objectId);
00039     Object &object = createObject();
00040     object.setName(cpyObj.getName());
00041     object.setModel(cpyObj.getModel());
00042     object.transform = cpyObj.transform;
00043     object.setDiffuseMap(cpyObj.getDiffuseMap());
00044     return object;
00045 }
00046
00047 ven::Light& ven::SceneManager::createLight(const float radius, const glm::vec4 color)
00048 {
00049     assert(m_currentLightId < MAX_LIGHTS && "Max light count exceeded!");
00050     Light light(m_currentLightId++);
00051     const unsigned int lightId = light.getId();
00052     light.color = color;
00053     light.transform.scale.x = radius;
00054     m_lights.emplace(lightId, std::move(light));
00055     return m_lights.at(lightId);
00056 }
00057
00058 ven::Light& ven::SceneManager::duplicateLight(const unsigned int lightId)
00059 {
00060     const Light &cpyLight = m_lights.at(lightId);
00061     Light& light = createLight(cpyLight.transform.scale.x, cpyLight.color);
00062     light.transform = cpyLight.transform;
00063     return light;
00064 }
00065
00066 void ven::SceneManager::updateBuffer(GlobalUbo &ubo, const unsigned long frameIndex, const float
frameTime)
00067 {
00068     uint8_t lightIndex = 0;
00069     const glm::mat4 rotateLight = rotate(glm::mat4(1.F), frameTime, {0.F, -1.F, 0.F});
00070
00071     for (Object & object : m_objects | std::views::values) {
00072         const ObjectBufferData data{
00073             .modelMatrix = object.transform.transformMatrix(),
00074             .normalMatrix = object.transform.normalMatrix()
00075         };
00076         m_uboBuffers.at(frameIndex)->writeToIndex(&data, object.getId());
00077         object.setBufferInfo(static_cast<int>(frameIndex),
m_uboBuffers.at(frameIndex)->descriptorInfoForIndex(object.getId()));
00078     }
00079
00080     for (Light &light : m_lights | std::views::values) {
00081         auto&[position, color, shininess, padding] = ubo.pointLights.at(lightIndex);
00082         light.transform.translation = glm::vec3(rotateLight * glm::vec4(light.transform.translation,
light.transform.scale.x));
00083         position = glm::vec4(light.transform.translation, light.transform.scale.x);
00084         color = light.color;
00085         shininess = light.getShininess();
00086         lightIndex++;
00087     }
00088     ubo.numLights = lightIndex;
00089 }
00090
00091 void ven::SceneManager::destroyEntity(std::vector<unsigned int> *objectsIds, std::vector<unsigned int>
*lightsIds)
00092 {
00093     for (const unsigned int objectId : *objectsIds) {
00094         m_objects.erase(objectId);
00095     }
00096     for (const unsigned int lightId : *lightsIds) {
00097         m_lights.erase(lightId);
00098     }
00099     objectsIds->clear();
00100     lightsIds->clear();
00101     m_destroyState = false;
00102 }

```

8.106 /home/runner/work/VEngine/VEngine/src/Utils/clock.cpp File Reference

```
#include "VEngine/Utils/Clock.hpp"
```

Include dependency graph for clock.cpp:



8.107 clock.cpp

[Go to the documentation of this file.](#)

```
00001 #include "VEngine/Utils/Clock.hpp"
00002
00003 void ven::Clock::update()
00004 {
00005     auto newTime = std::chrono::high_resolution_clock::now();
00006     m_deltaTime = newTime - m_startTime;
00007     m_startTime = newTime;
00008 }
00009
00010 void ven::Clock::stop()
00011 {
00012     if (m_isStopped) {
00013         return;
00014     }
00015
00016     m_stopTime = std::chrono::high_resolution_clock::now();
00017     m_isStopped = true;
00018 }
00019
00020 void ven::Clock::resume()
00021 {
00022     if (!m_isStopped) {
00023         return;
00024     }
00025
00026     m_startTime += std::chrono::high_resolution_clock::now() - m_stopTime;
00027     m_isStopped = false;
00028 }
```

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