

MAGE

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Chapter 1

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Chapter 2

Hierarchical Index

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Chapter 3

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Chapter 4

Namespace Documentation

4.1 mage Namespace Reference

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- struct [AlignedData](#)
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- class [BasicPixelShader](#)
- class [BasicVertexShader](#)
- class [BehaviorScript](#)
- class [BigEndianBinaryReader](#)
- class [BigEndianBinaryWriter](#)
- class [BinaryReader](#)
- struct [BS](#)
- class [Camera](#)
- class [CameraNode](#)
- class [CharacterMotorScript](#)
- struct [Color](#)
- struct [ColorString](#)
- struct [CombinedShader](#)
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- struct [ConditionVariable](#)
- struct [ConstantBuffer](#)
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- class [VSReader](#)
- class [VSWriter](#)
- class [WireframeScript](#)
- class [Writer](#)
- struct [XYZSpectrum](#)

Typedefs

- `typedef DerivedCameraNode< OrthographicCamera > OrthographicCameraNode`
- `typedef DerivedCameraNode< PerspectiveCamera > PerspectiveCameraNode`
- `typedef DerivedLightNode< AmbientLight > AmbientLightNode`
- `typedef DerivedLightNode< DirectionalLight > DirectionalLightNode`
- `typedef DerivedLightNode< OmniLight > OmniLightNode`
- `typedef DerivedLightNode< SpotLight > SpotLightNode`
- `template<typename T >`
`using UniquePtr = std::unique_ptr< T >`
- `template<typename T >`
`using SharedPtr = std::shared_ptr< T >`
- `template<typename T >`
`using WeakPtr = std::weak_ptr< T >`
- `template<typename T >`
`using ComPtr = Microsoft::WRL::ComPtr< T >`
- `typedef std::unique_ptr< void, HandleCloser > UniqueHandle`
- `typedef SharedPtr< void > SharedHandle`
- `typedef std::unique_ptr< FILE, FileStreamCloser > UniqueFileStream`
- `template<typename KeyT , typename ResourceT >`
`using ResourceMap = map< KeyT, WeakPtr< ResourceT > >`
- `typedef XMINT2 int2`
- `typedef XMINT3 int3`
- `typedef XMFLOAT2 float2`
- `typedef XMFLOAT3 float3`
- `typedef XMFLOAT4 float4`
- `typedef XMFLOAT4 color`

Enumerations

- `enum ErrorDisposition { ERROR_DISPOSITION_IGNORE, ERROR_DISPOSITION_CONTINUE, ERROR_DISPOSITION_ABORT }`
- `enum ReadWriteMutexLockType { ReadWriteMutexLockType_Read, ReadWriteMutexLockType_Write }`
- `enum RotationAxes { RotationAxes_MouseX = 1, RotationAxes_MouseY = 2, RotationAxes_MouseXAndY = RotationAxes_MouseX | RotationAxes_MouseY }`
- `enum VariableType { VariableType_Bool, VariableType_Int, VariableType_Int2, VariableType_Int3, VariableType_Float, VariableType_Float2, VariableType_Float3, VariableType_Float4, VariableType_Color, VariableType_String }`
- `enum SpriteEffect { SpriteEffect_None = 0, SpriteEffect_FlipHorizontally = 1, SpriteEffect_FlipVertically = 2, SpriteEffect_FlipBoth = SpriteEffect_FlipHorizontally | SpriteEffect_FlipVertically }`
- `enum SpriteSortMode { SpriteSortMode_Deferred, SpriteSortMode_Immediate, SpriteSortMode_Texture, SpriteSortMode_BackToFront, SpriteSortMode_FrontToBack }`
- `enum TokenResult { TokenResult_Valid, TokenResult_None, TokenResult_Invalid }`
- `enum DDS_MISC_FLAGS2 { DDS_MISC_FLAGS2_ALPHA_MODE_MASK = 0x7L }`
- `enum DDS_ALPHA_MODE { DDS_ALPHA_MODE_UNKNOWN = 0, DDS_ALPHA_MODE_STRAIGHT = 1, DDS_ALPHA_MODE_P朴实EMULTIPLIED = 2, DDS_ALPHA_MODE_OPAQUE = 3, DDS_ALPHA_MODE_CUSTOM = 4 }`

Functions

- void `ReadBinaryFile` (const wchar_t *fname, `UniquePtr< uint8_t[] >` &data, size_t *size)
- template<typename DataT>
 const DataT * `BytesBigEndianToValue` (const uint8_t *bytes)
- int8_t `BytesBigEndianToInt8` (const uint8_t *bytes)
- uint8_t `BytesBigEndianToUInt8` (const uint8_t *bytes)
- int16_t `BytesBigEndianToInt16` (const uint8_t *bytes)
- uint16_t `BytesBigEndianToUInt16` (const uint8_t *bytes)
- int32_t `BytesBigEndianToInt32` (const uint8_t *bytes)
- uint32_t `BytesBigEndianToUInt32` (const uint8_t *bytes)
- int64_t `BytesBigEndianToInt64` (const uint8_t *bytes)
- uint64_t `BytesBigEndianToUInt64` (const uint8_t *bytes)
- float `BytesBigEndianToFloat` (const uint8_t *bytes)
- double `BytesBigEndian.ToDouble` (const uint8_t *bytes)
- int8_t `BytesLittleEndianToInt8` (const uint8_t *bytes)
- uint8_t `BytesLittleEndianToUInt8` (const uint8_t *bytes)
- int16_t `BytesLittleEndianToInt16` (const uint8_t *bytes)
- uint16_t `BytesLittleEndianToUInt16` (const uint8_t *bytes)
- int32_t `BytesLittleEndianToInt32` (const uint8_t *bytes)
- uint32_t `BytesLittleEndianToUInt32` (const uint8_t *bytes)
- int64_t `BytesLittleEndianToInt64` (const uint8_t *bytes)
- uint64_t `BytesLittleEndianToUInt64` (const uint8_t *bytes)
- float `BytesLittleEndianToFloat` (const uint8_t *bytes)
- double `BytesLittleEndian.ToDouble` (const uint8_t *bytes)
- int8_t `BytesToInt8` (const uint8_t *bytes)
- uint8_t `BytesToUInt8` (const uint8_t *bytes)
- int16_t `BytesToInt16` (const uint8_t *bytes, bool big_endian)
- uint16_t `BytesToUInt16` (const uint8_t *bytes, bool big_endian)
- int32_t `BytesToInt32` (const uint8_t *bytes, bool big_endian)
- uint32_t `BytesToUInt32` (const uint8_t *bytes, bool big_endian)
- int64_t `BytesToInt64` (const uint8_t *bytes, bool big_endian)
- uint64_t `BytesToUInt64` (const uint8_t *bytes, bool big_endian)
- float `BytesToFloat` (const uint8_t *bytes, bool big_endian)
- double `Bytes.ToDouble` (const uint8_t *bytes, bool big_endian)
- `_declspec` (align(16)) struct LightDataBuffer final
- `_declspec` (align(16)) struct MaterialBuffer final
- `UniquePtr< OrthographicCamera >` `CreateOrthographicCamera` (float width, float height, float near_z, float far_z)
- `UniquePtr< PerspectiveCamera >` `CreatePerspectiveCamera` (float fov_y, float near_z, float far_z)
- template<typename ContainerT, typename PredicateT>
 void `Removelf` (ContainerT &container, const PredicateT &predicate)
- template<typename ContainerT>
 void `RemoveAndDestructAllElements` (ContainerT &container)
- template<typename ContainerT>
 void `RemoveAndDestructAllSecondElements` (ContainerT &container)
- void `PrintConsoleHeader` ()
- bool `FileExists` (const wstring &fname)
- const string `GetFilename` (const string &path, const string &name)
- const wstring `GetFilename` (const wstring &path, const wstring &name)
- const string `GetFileExtension` (const string &fname)
- const wstring `GetFileExtension` (const wstring &fname)
- const string `GetFileName` (const string &fname)
- const wstring `GetFileName` (const wstring &fname)
- const string `GetPathName` (const string &fname)

- const wstring [GetPathName](#) (const wstring &fname)
- const string [GetFilenameWithoutFileExtension](#) (const string &fname)
- const wstring [GetFilenameWithoutFileExtension](#) (const wstring &fname)
- [SharedPtr< SpriteFont >](#) [CreateFont](#) (const wstring &fname, const [SpriteFontDescriptor](#) &desc)
- void [ImportSpriteFontFromFile](#) (const wstring &fname, ID3D11Device2 *device, [SpriteFontOutput](#) &output, const [SpriteFontDescriptor](#) &desc)
- void [ImportFontFromFile](#) (const wstring &fname, ID3D11Device2 *device, [SpriteFontOutput](#) &output, const [SpriteFontDescriptor](#) &desc)
- static const char * [FindWordEnd](#) (const char *buffer)
- static void [ProcessError](#) (const char *format, const va_list args, const string &error_type, [ErrorDisposition](#) disposition)
- void [Debug](#) (const char *format,...)
- void [Info](#) (const char *format,...)
- void [Warning](#) (const char *format,...)
- void [Error](#) (const char *format,...)
- void [Fatal](#) (const char *format,...)
- uint16_t [ConsoleWidth](#) ()
- void [InitializeConsole](#) ()
- void [ImportMaterialFromFile](#) (const wstring &fname, vector< [Material](#) > &materials)
- void [ImportMTLMaterialFromFile](#) (const wstring &fname, vector< [Material](#) > &materials)
- const [AABB Union](#) (const [AABB](#) &aabb, const [Point3](#) &point)
- const [AABB Union](#) (const [AABB](#) &aabb1, const [AABB](#) &aabb2)
- const [AABB Overlap](#) (const [AABB](#) &aabb1, const [AABB](#) &aabb2)
- const [AABB OverlapStrict](#) (const [AABB](#) &aabb1, const [AABB](#) &aabb2)
- template<typename VertexT >
const [AABB Union](#) (const [AABB](#) &aabb, const VertexT &vertex)
- ostream & [operator<<](#) (ostream &os, const XMFLOAT2 &v)
- ostream & [operator<<](#) (ostream &os, const XMFLOAT3 &v)
- ostream & [operator<<](#) (ostream &os, const XMFLOAT4 &v)
- const [UV InvertHandness](#) (const [UV](#) &uv)
- const [Point3 InvertHandness](#) (const [Point3](#) &point)
- const [Direction3 InvertHandness](#) (const [Direction3](#) &direction)
- const [Normal3 InvertHandness](#) (const [Normal3](#) &normal)
- template<typename ValueT >
ValueT [Clamp](#) (ValueT value, ValueT low=0, ValueT high=1)
- float [ClampAngleDegrees](#) (float angle)
- float [ClampAngleRadians](#) (float angle)
- float [ClampAngleDegrees](#) (float angle, float min_angle, float max_angle)
- float [ClampAngleRadians](#) (float angle, float min_angle, float max_angle)
- float [ConvertNormalizedToAbsoluteScreenX](#) (float x)
- float [ConvertNormalizedToAbsoluteScreenY](#) (float y)
- const XMVECTOR [ConvertNormalizedToAbsoluteScreen](#) (const XMVECTOR &position)
- float [ConvertAbsoluteToNormalizedScreenX](#) (float x)
- float [ConvertAbsoluteToNormalizedScreenY](#) (float y)
- const XMVECTOR [ConvertAbsoluteToNormalizedScreen](#) (const XMVECTOR &position)
- const XMFLOAT2 [ConvertNormalizedToAbsoluteScreen](#) (float x, float y)
- const XMFLOAT2 [ConvertNormalizedToAbsoluteScreen](#) (const XMFLOAT2 &position)
- const XMFLOAT2 [ConvertAbsoluteToNormalizedScreen](#) (float x, float y)
- const XMFLOAT2 [ConvertAbsoluteToNormalizedScreen](#) (const XMFLOAT2 &position)
- void * [AllocAligned](#) (size_t size, size_t alignment=16)
- template<typename DataT >
DataT * [AllocAligned](#) (size_t count)
- void [FreeAligned](#) (void *ptr)
- template<typename T , typename U >
[UniquePtr< T >](#) [static_pointer_cast](#) ([UniquePtr< U >](#) &&ptr)

- template<typename T , typename U >
`UniquePtr< T > dynamic_pointer_cast (UniquePtr< U > &&ptr)`
- template<typename T , typename U >
`UniquePtr< T > const_pointer_cast (UniquePtr< U > &&ptr)`
- template<typename T , typename U >
`UniquePtr< T > reinterpret_pointer_cast (UniquePtr< U > &&ptr)`
- void `DestructHandle` (HANDLE handle)
- HANDLE `SafeHandle` (HANDLE handle)
- `SharedHandle CreateSharedHandle` (HANDLE handle)
- template<typename VertexT , typename IndexT >
`void ImportMSHMeshFromFile (const wstring &fname, vector< VertexT > &vertices, vector< IndexT > &indices)`
- template<typename VertexT , typename IndexT >
`void ExportMSHMeshToFile (const wstring &fname, const vector< VertexT > &vertices, const vector< IndexT > &indices)`
- template<typename VertexT >
`void ImportOBJMeshFromFile (const wstring &fname, ModelOutput< VertexT > &model_output, const MeshDescriptor< VertexT > &mesh_desc=MeshDescriptor< VertexT >())`
- template<typename VertexT >
`void ImportMDLModelFromFile (const wstring &fname, ModelOutput< VertexT > &model_output)`
- template<typename VertexT >
`void ExportMDLModelToFile (const wstring &fname, const ModelOutput< VertexT > &model_output)`
- `ID3D11Device2 * GetModelRenderingDevice` ()
- `ID3D11DeviceContext2 * GetModelRenderingDeviceContext` ()
- `ResourceFactory * GetModelResourceFactory` ()
- template<typename VertexT >
`SharedPtr< ModelDescriptor > CreateModelDescriptor (const wstring &fname, const MeshDescriptor< VertexT > &desc)`
- template<typename VertexT >
`void ImportModelFromFile (const wstring &fname, ModelOutput< VertexT > &model_output, const MeshDescriptor< VertexT > &mesh_desc=MeshDescriptor< VertexT >())`
- template<typename VertexT >
`void ExportModelToFile (const wstring &fname, const ModelOutput< VertexT > &model_output)`
- template<typename T >
`T * AtomicCompareAndSwapPointer (T **destination, T *exchange, T *comparand)`
- int32_t `AtomicAdd` (AtomicInt32 *addend, int32_t value)
- int32_t `AtomicCompareAndSwap` (AtomicInt32 *destination, int32_t exchange, int32_t comparand)
- float `AtomicAdd` (volatile float *addend, float value)
- size_t `NumberOfSystemCores` ()
- INT_PTR CALLBACK `SettingsDialogProcDelegate` (HWND hwndDlg, UINT uMsg, WPARAM wParam, LPARAM lParam)
- bool `RejectDisplayMode` (const DXGI_MODE_DESC1 &display_mode_desc)
- size_t `ConvertResolution` (const DXGI_MODE_DESC1 &desc)
- size_t `ConvertRefreshRate` (const DXGI_MODE_DESC1 &desc)
- unsigned int `GetRefreshRate` (const DXGI_MODE_DESC1 &desc)
- size_t `BitsPerPixel` (DXGI_FORMAT format)
- DXGI_FORMAT `ConvertToSRGB` (DXGI_FORMAT format)
- HRESULT `CreateBlendState` (ID3D11Device2 *device, ID3D11BlendState **blend_state, D3D11_BLEND src_blend, D3D11_BLEND dest_blend)
- HRESULT `CreateOpaqueBlendState` (ID3D11Device2 *device, ID3D11BlendState **blend_state)
- HRESULT `CreateAlphaBlendState` (ID3D11Device2 *device, ID3D11BlendState **blend_state)
- HRESULT `CreateAdditiveBlendState` (ID3D11Device2 *device, ID3D11BlendState **blend_state)
- HRESULT `CreateNonPremultipliedBlendState` (ID3D11Device2 *device, ID3D11BlendState **blend_state)
- HRESULT `CreateDepthStencilState` (ID3D11Device2 *device, ID3D11DepthStencilState **depth_stencil_state, bool enable, bool write_enable)

- `HRESULT CreateDepthNoneDepthStencilState (ID3D11Device2 *device, ID3D11DepthStencilState **depth_stencil_state)`
- `HRESULT CreateDepthDefaultDepthStencilState (ID3D11Device2 *device, ID3D11DepthStencilState **depth_stencil_state)`
- `HRESULT CreateDepthReadDepthStencilState (ID3D11Device2 *device, ID3D11DepthStencilState **depth_stencil_state)`
- `HRESULT CreateRasterizerState (ID3D11Device2 *device, ID3D11RasterizerState **rasterizer_state, D3D11_CULL_MODE cull_mode, D3D11_FILL_MODE fill_mode)`
- `HRESULT CreateCullNoneRasterizerState (ID3D11Device2 *device, ID3D11RasterizerState **rasterizer_state)`
- `HRESULT CreateCullClockwiseRasterizerState (ID3D11Device2 *device, ID3D11RasterizerState **rasterizer_state)`
- `HRESULT CreateCullCounterClockwiseRasterizerState (ID3D11Device2 *device, ID3D11RasterizerState **rasterizer_state)`
- `HRESULT CreateWireframeRasterizerState (ID3D11Device2 *device, ID3D11RasterizerState **rasterizer_state)`
- `HRESULT CreateSamplerState (ID3D11Device2 *device, ID3D11SamplerState **sampler_state, D3D11_FILTER filter, D3D11_TEXTURE_ADDRESS_MODE address_mode)`
- `HRESULT CreatePointWrapSamplerState (ID3D11Device2 *device, ID3D11SamplerState **sampler_state)`
- `HRESULT CreatePointClampSamplerState (ID3D11Device2 *device, ID3D11SamplerState **sampler_state)`
- `HRESULT CreateLinearWrapSamplerState (ID3D11Device2 *device, ID3D11SamplerState **sampler_state)`
- `HRESULT CreateLinearClampSamplerState (ID3D11Device2 *device, ID3D11SamplerState **sampler_state)`
- `HRESULT CreateAnisotropicWrapSamplerState (ID3D11Device2 *device, ID3D11SamplerState **sampler_state)`
- `HRESULT CreateAnisotropicClampSamplerState (ID3D11Device2 *device, ID3D11SamplerState **sampler_state)`
- template<typename VertexT >
`HRESULT CreateStaticVertexBuffer (ID3D11Device2 *device, ID3D11Buffer **buffer, const VertexT *vertices, size_t nb_vertices)`
- template<typename VertexT >
`HRESULT CreateDynamicVertexBuffer (ID3D11Device2 *device, ID3D11Buffer **buffer, const VertexT *vertices, size_t nb_vertices)`
- template<typename IndexT >
`HRESULT CreateStaticIndexBuffer (ID3D11Device2 *device, ID3D11Buffer **buffer, const IndexT *indices, size_t nb_indices)`
- template<typename DataT >
`HRESULT CreateConstantBuffer (ID3D11Device2 *device, ID3D11Buffer **buffer, size_t count=1)`
- template<typename DataT >
`HRESULT CreateStructuredBuffer (ID3D11Device2 *device, ID3D11Buffer **buffer, size_t count=1)`
- `ID3D11Device2 * GetRenderingDevice ()`
- `ID3D11DeviceContext2 * GetRenderingContext ()`
- `ResourceFactory * GetResourceFactory ()`
- `SharedPtr< VariableScript > CreateVariableScript (const wstring &fname, bool import)`
- `void ImportVariableScriptFromFile (const wstring &fname, vector< Variable > &variable_buffer)`
- `void ExportVariableScriptToFile (const wstring &fname, const vector< Variable > &variable_buffer)`
- `void ImportVSFromFile (const wstring &fname, vector< Variable > &variable_buffer)`
- `void ExportVSToFile (const wstring &fname, const vector< Variable > &variable_buffer)`
- `const CombinedShader CreateDiffuseShader ()`
- `const CombinedShader CreateLambertianShader ()`
- `const CombinedShader CreatePhongShader ()`
- `const CombinedShader CreateBlinnPhongShader ()`
- `const CombinedShader CreateModifiedBlinnPhongShader ()`
- `const CompiledVertexShader CreateCompiledTransformVertexShader ()`

- const [CompiledPixelShader CreateCompiledDiffusePixelShader \(\)](#)
- const [CompiledPixelShader CreateCompiledLambertianPixelShader \(\)](#)
- const [CompiledPixelShader CreateCompiledPhongPixelShader \(\)](#)
- const [CompiledPixelShader CreateCompiledBlinnPhongPixelShader \(\)](#)
- const [CompiledPixelShader CreateCompiledModifiedBlinnPhongPixelShader \(\)](#)
- const [CompiledVertexShader CreateCompiledSpriteVertexShader \(\)](#)
- const [CompiledPixelShader CreateCompiledSpritePixelShader \(\)](#)
- [HRESULT CompileShaderFromFile \(const wstring &fname, const string &entry_point, const string &shader _target, ID3DBlob **output_blob\)](#)
- const [CombinedShader CreateSpriteShader \(\)](#)
- const [XMMATRIX GetViewportTransform \(ID3D11DeviceContext *device_context, DXGI_MODE_ROTATION rotation_mode\)](#)
- const [XMMATRIX GetViewportTransform \(ID3D11DeviceContext *device_context, DXGI_MODE_ROTATION rotation_mode, D3D11_VIEWPORT *viewport\)](#)
- const [XMMATRIX GetViewportTransform \(const D3D11_VIEWPORT &viewport, DXGI_MODE_ROTATION rotation_mode\)](#)
- const [XMVECTOR GetTexture2DSize \(ID3D11ShaderResourceView *texture\)](#)
- const [XMVECTOR XMVectorLeftTopRightBottom \(const RECT &rect\)](#)
- const [XMVECTOR XMVectorLeftTopWidthHeight \(const RECT &rect\)](#)
- const char * [str_escape_first \(const char *str, char c\)](#)
- char * [str_escape_first \(char *str, char c\)](#)
- const wchar_t * [str_escape_first \(const wchar_t *str, wchar_t c\)](#)
- wchar_t * [str_escape_first \(wchar_t *str, wchar_t c\)](#)
- char * [str_gets \(char *str, int num, const char **input\)](#)
- wchar_t * [str_gets \(wchar_t *str, int num, const wchar_t **input\)](#)
- const wchar_t * [str_convert \(const char *str\)](#)
- const char * [str_convert \(const wchar_t *str\)](#)
- const wstring [str_convert \(const string &str\)](#)
- const string [str_convert \(const wstring &str\)](#)
- bool [str_equals \(const char *str1, const char *str2\)](#)
- bool [str_equals \(const wchar_t *str1, const wchar_t *str2\)](#)
- bool [str_contains \(const char *str1, const char *str2\)](#)
- bool [str_contains \(const wchar_t *str1, const wchar_t *str2\)](#)
- bool [str_contains \(const char *str, char c\)](#)
- bool [str_contains \(const wchar_t *str, wchar_t c\)](#)
- [TokenResult StringToBool \(const char *str, bool &result\)](#)
- [TokenResult StringToInt8 \(const char *str, int8_t &result\)](#)
- [TokenResult StringToUInt8 \(const char *str, uint8_t &result\)](#)
- [TokenResult StringToInt16 \(const char *str, int16_t &result\)](#)
- [TokenResult StringToUInt16 \(const char *str, uint16_t &result\)](#)
- [TokenResult StringToInt32 \(const char *str, int32_t &result\)](#)
- [TokenResult StringToUInt32 \(const char *str, uint32_t &result\)](#)
- [TokenResult StringToInt64 \(const char *str, int64_t &result\)](#)
- [TokenResult StringToUInt64 \(const char *str, uint64_t &result\)](#)
- [TokenResult StringToFloat \(const char *str, float &result\)](#)
- [TokenResult String.ToDouble \(const char *str, double &result\)](#)
- [TokenResult StringToBool \(const char *begin, const char *end, bool &result\)](#)
- [TokenResult StringToInt8 \(const char *begin, const char *end, int8_t &result\)](#)
- [TokenResult StringToUInt8 \(const char *begin, const char *end, uint8_t &result\)](#)
- [TokenResult StringToInt16 \(const char *begin, const char *end, int16_t &result\)](#)
- [TokenResult StringToUInt16 \(const char *begin, const char *end, uint16_t &result\)](#)
- [TokenResult StringToInt32 \(const char *begin, const char *end, int32_t &result\)](#)
- [TokenResult StringToUInt32 \(const char *begin, const char *end, uint32_t &result\)](#)
- [TokenResult StringToInt64 \(const char *begin, const char *end, int64_t &result\)](#)
- [TokenResult StringToUInt64 \(const char *begin, const char *end, uint64_t &result\)](#)

- `TokenResult StringToFloat (const char *begin, const char *end, float &result)`
- `TokenResult String.ToDouble (const char *begin, const char *end, double &result)`
- `TokenResult StringPrefixToInt8 (const char *str, int8_t &result)`
- `TokenResult StringPrefixToUInt8 (const char *str, uint8_t &result)`
- `TokenResult StringPrefixToInt16 (const char *str, int16_t &result)`
- `TokenResult StringPrefixToUInt16 (const char *str, uint16_t &result)`
- `TokenResult StringPrefixToInt32 (const char *str, int32_t &result)`
- `TokenResult StringPrefixToUInt32 (const char *str, uint32_t &result)`
- `TokenResult StringPrefixToInt64 (const char *str, int64_t &result)`
- `TokenResult StringPrefixToUInt64 (const char *str, uint64_t &result)`
- `TokenResult StringPrefixToFloat (const char *str, float &result)`
- `TokenResult StringPrefixToDouble (const char *str, double &result)`
- `TokenResult ReadChars (char *str, char **context, char **result, const char *delimiters)`
- `TokenResult ReadString (char *str, char **context, string &result, const char *delimiters)`
- `TokenResult ReadQuotedString (char *str, char **context, string &result, const char *delimiters)`
- `TokenResult ReadBool (char *str, char **context, bool &result, const char *delimiters)`
- `TokenResult ReadInt8 (char *str, char **context, int8_t &result, const char *delimiters)`
- `TokenResult ReadUInt8 (char *str, char **context, uint8_t &result, const char *delimiters)`
- `TokenResult ReadInt16 (char *str, char **context, int16_t &result, const char *delimiters)`
- `TokenResult ReadUInt16 (char *str, char **context, uint16_t &result, const char *delimiters)`
- `TokenResult ReadInt32 (char *str, char **context, int32_t &result, const char *delimiters)`
- `TokenResult ReadUInt32 (char *str, char **context, uint32_t &result, const char *delimiters)`
- `TokenResult ReadInt64 (char *str, char **context, int64_t &result, const char *delimiters)`
- `TokenResult ReadUInt64 (char *str, char **context, uint64_t &result, const char *delimiters)`
- `TokenResult ReadFloat (char *str, char **context, float &result, const char *delimiters)`
- `TokenResult ReadDouble (char *str, char **context, double &result, const char *delimiters)`
- `TokenResult ReadFloat2 (char *str, char **context, XMFLOAT2 &result, const char *delimiters)`
- `TokenResult ReadFloat3 (char *str, char **context, XMFLOAT3 &result, const char *delimiters)`
- `TokenResult ReadFloat4 (char *str, char **context, XMFLOAT4 &result, const char *delimiters)`
- `TokenResult HasChars (const char *str, const char *delimiters)`
- `TokenResult HasString (const char *str, const char *delimiters)`
- `TokenResult HasQuotedString (const char *str, const char *delimiters)`
- `TokenResult HasBool (const char *str, const char *delimiters)`
- `TokenResult HasInt8 (const char *str, const char *delimiters)`
- `TokenResult HasUInt8 (const char *str, const char *delimiters)`
- `TokenResult HasInt16 (const char *str, const char *delimiters)`
- `TokenResult HasUInt16 (const char *str, const char *delimiters)`
- `TokenResult HasInt32 (const char *str, const char *delimiters)`
- `TokenResult HasUInt32 (const char *str, const char *delimiters)`
- `TokenResult HasInt64 (const char *str, const char *delimiters)`
- `TokenResult HasUInt64 (const char *str, const char *delimiters)`
- `TokenResult HasFloat (const char *str, const char *delimiters)`
- `TokenResult HasDouble (const char *str, const char *delimiters)`
- `char * SkipDelimiters (char *str, const char *delimiters)`
- `const char * SkipDelimiters (const char *str, const char *delimiters)`
- `char * GotoDelimiters (char *str, const char *delimiters)`
- `const char * GotoDelimiters (const char *str, const char *delimiters)`
- `uint64_t ConvertTimestamp (const FILETIME &ftime)`
- `uint64_t GetCurrentSystemTimestamp ()`
- `void GetCurrentCoreTimestamp (HANDLE handle_process, uint64_t *kernel_mode_timestamp, uint64_t *user_mode_timestamp)`
- `void GetCurrentCoreTimestamp (uint64_t *kernel_mode_timestamp, uint64_t *user_mode_timestamp)`
- `uint64_t GetVirtualMemoryUsage ()`
- `uint64_t GetPhysicalMemoryUsage ()`

- template<UINT TNameLength>
void **SetDebugObjectName** (_In_ ID3D11DeviceChild *resource, _In_ const char(&name)[TNameLength])
- static HRESULT **LoadTextureDataFromFile** (_In_z_ const wchar_t *file_name, std::unique_ptr< uint8_t[]> &dds_data, DDS_HEADER **header, uint8_t **bit_data, size_t *bit_size)
- static void **GetSurfaceInfo** (_In_size_t width, _In_size_t height, _In DXGI_FORMAT fmt, _Out_opt_size_t *out_nb_bytes, _Out_opt_size_t *out_row_bytes, _Out_opt_size_t *out_nb_rows)
- static DXGI_FORMAT **GetDXGIFormat** (const DDS_PIXELFORMAT &ddpf)
- static DXGI_FORMAT **MakeSRGB** (_In DXGI_FORMAT format)
- static HRESULT **FillInitData** (_In_size_t width, _In_size_t height, _In_size_t depth, _In_size_t mip_count, _In_size_t array_size, _In DXGI_FORMAT format, _In_size_t maxsize, _In_size_t bit_size, _In_reads_bytes_(bit_size) const uint8_t *bit_data, _Out_size_t &width, _Out_size_t &height, _Out_size_t &depth, _Out_size_t &skip_mip, _Out_writes_(mip_count *array_size) D3D11_SUBRESOURCE_DATA *init_data)
- static HRESULT **CreateD3DResources** (_In_ID3D11Device2 *device, _In_uint32_t res_dim, _In_size_t width, _In_size_t height, _In_size_t depth, _In_size_t mip_count, _In_size_t array_size, _In DXGI_FORMAT format, _In_D3D11_USAGE usage, _In_uint32_t bindFlags, _In_uint32_t cpu_access_flags, _In_uint32_t misc_flags, _In_bool forceSRGB, _In_bool is_cube_map, _In_reads_opt_(mip_count *array_size) D3D11_SUBRESOURCE_DATA *init_data, _Outptr_opt_ID3D11Resource **texture, _Outptr_opt_ID3D11ShaderResourceView **texture_view)
- static HRESULT **CreateTextureFromDDS** (_In_ID3D11Device2 *device, _In_opt_ID3D11DeviceContext *device_context, _In_const DDS_HEADER *header, _In_reads_bytes_(bit_size) const uint8_t *bit_data, _In_size_t bit_size, _In_size_t maxsize, _In_D3D11_USAGE usage, _In_uint32_t bindFlags, _In_uint32_t cpu_access_flags, _In_uint32_t misc_flags, _In_bool forceSRGB, _Outptr_opt_ID3D11Resource **texture, _Outptr_opt_ID3D11ShaderResourceView **texture_view)
- static DDS_ALPHA_MODE **GetAlphaMode** (_In_const DDS_HEADER *header)
- _Use_decl_annotations_ HRESULT **CreateDDSTextureFromMemory** (ID3D11Device2 *device, const uint8_t *dds_data, size_t dds_dataSize, ID3D11Resource **texture, ID3D11ShaderResourceView **texture_view, size_t maxsize, DDS_ALPHA_MODE *alpha_mode)
- _Use_decl_annotations_ HRESULT **CreateDDSTextureFromMemory** (ID3D11Device2 *device, ID3D11DeviceContext *device_context, const uint8_t *dds_data, size_t dds_dataSize, ID3D11Resource **texture, ID3D11ShaderResourceView **texture_view, size_t maxsize, DDS_ALPHA_MODE *alpha_mode)
- _Use_decl_annotations_ HRESULT **CreateDDSTextureFromMemoryEx** (ID3D11Device2 *device, const uint8_t *dds_data, size_t dds_dataSize, size_t maxsize, D3D11_USAGE usage, uint32_t bindFlags, uint32_t cpu_access_flags, uint32_t misc_flags, bool forceSRGB, ID3D11Resource **texture, ID3D11ShaderResourceView **texture_view, DDS_ALPHA_MODE *alpha_mode)
- _Use_decl_annotations_ HRESULT **CreateDDSTextureFromMemoryEx** (ID3D11Device2 *device, ID3D11DeviceContext *device_context, const uint8_t *dds_data, size_t dds_dataSize, size_t maxsize, D3D11_USAGE usage, uint32_t bindFlags, uint32_t cpu_access_flags, uint32_t misc_flags, bool forceSRGB, ID3D11Resource **texture, ID3D11ShaderResourceView **texture_view, DDS_ALPHA_MODE *alpha_mode)
- _Use_decl_annotations_ HRESULT **CreateDDSTextureFromFile** (ID3D11Device2 *device, const wchar_t *file_name, ID3D11Resource **texture, ID3D11ShaderResourceView **texture_view, size_t maxsize, DDS_ALPHA_MODE *alpha_mode)
- _Use_decl_annotations_ HRESULT **CreateDDSTextureFromFile** (ID3D11Device2 *device, ID3D11DeviceContext *device_context, const wchar_t *file_name, ID3D11Resource **texture, ID3D11ShaderResourceView **texture_view, size_t maxsize, DDS_ALPHA_MODE *alpha_mode)
- _Use_decl_annotations_ HRESULT **CreateDDSTextureFromFileEx** (ID3D11Device2 *device, const wchar_t *file_name, size_t maxsize, D3D11_USAGE usage, uint32_t bindFlags, uint32_t cpu_access_flags, uint32_t misc_flags, bool forceSRGB, ID3D11Resource **texture, ID3D11ShaderResourceView **texture_view, DDS_ALPHA_MODE *alpha_mode)
- _Use_decl_annotations_ HRESULT **CreateDDSTextureFromFileEx** (ID3D11Device2 *device, ID3D11DeviceContext *device_context, const wchar_t *file_name, size_t maxsize, D3D11_USAGE usage, uint32_t bindFlags, uint32_t cpu_access_flags, uint32_t misc_flags, bool forceSRGB, ID3D11Resource **texture, ID3D11ShaderResourceView **texture_view, DDS_ALPHA_MODE *alpha_mode)
- HRESULT **CreateDDSTextureFromMemory** (_In_ID3D11Device2 *device, _In_reads_bytes_(dds_dataSize) const uint8_t *dds_data, _In_size_t dds_dataSize, _Outptr_opt_ID3D11Resource **texture, _Outptr_opt_ID3D11ShaderResourceView **texture_view, _In_size_t maxsize=0, _Out_opt_DDS_ALPHA_MODE *alpha_mode=nullptr)

- HRESULT [CreateDDSTextureFromFile](#) (_In_ ID3D11Device2 *device, _In_z_ const wchar_t *szFileName, _Outptr_opt_ ID3D11Resource **texture, _Outptr_opt_ ID3D11ShaderResourceView **texture_view, _In_ size_t maxsize=0, _Out_opt_ DDS_ALPHA_MODE *alpha_mode=nullptr)
- HRESULT [CreateDDSTextureFromMemory](#) (_In_ ID3D11Device2 *device, _In_opt_ ID3D11DeviceContext *device_context, _In_reads_bytes_(dds_dataSize) const uint8_t *dds_data, _In_ size_t dds_dataSize, _Outptr_opt_ ID3D11Resource **texture, _Outptr_opt_ ID3D11ShaderResourceView **texture_view, _In_ size_t maxsize=0, _Out_opt_ DDS_ALPHA_MODE *alpha_mode=nullptr)
- HRESULT [CreateDDSTextureFromFile](#) (_In_ ID3D11Device2 *device, _In_opt_ ID3D11DeviceContext *device_context, _In_z_ const wchar_t *szFileName, _Outptr_opt_ ID3D11Resource **texture, _Outptr_opt_ ID3D11ShaderResourceView **texture_view, _In_ size_t maxsize=0, _Out_opt_ DDS_ALPHA_MODE *alpha_mode=nullptr)
- HRESULT [CreateDDSTextureFromMemoryEx](#) (_In_ ID3D11Device2 *device, _In_reads_bytes_(dds_dataSize) const uint8_t *dds_data, _In_ size_t dds_dataSize, _In_ size_t maxsize, _In_ D3D11_USAGE usage, _In_ uint32_t bindFlags, _In_ uint32_t cpu_access_flags, _In_ uint32_t misc_flags, _In_ bool forceSRGB, _Outptr_opt_ ID3D11Resource **texture, _Outptr_opt_ ID3D11ShaderResourceView **texture_view, _Out_opt_ DDS_ALPHA_MODE *alpha_mode=nullptr)
- HRESULT [CreateDDSTextureFromFileEx](#) (_In_ ID3D11Device2 *device, _In_z_ const wchar_t *szFileName, _In_ size_t maxsize, _In_ D3D11_USAGE usage, _In_ uint32_t bindFlags, _In_ uint32_t cpu_access_flags, _In_ uint32_t misc_flags, _In_ bool forceSRGB, _Outptr_opt_ ID3D11Resource **texture, _Outptr_opt_ ID3D11ShaderResourceView **texture_view, _Out_opt_ DDS_ALPHA_MODE *alpha_mode=nullptr)
- HRESULT [CreateDDSTextureFromMemoryEx](#) (_In_ ID3D11Device2 *device, _In_opt_ ID3D11DeviceContext *device_context, _In_reads_bytes_(dds_dataSize) const uint8_t *dds_data, _In_ size_t dds_dataSize, _In_ size_t maxsize, _In_ D3D11_USAGE usage, _In_ uint32_t bindFlags, _In_ uint32_t cpu_access_flags, _In_ uint32_t misc_flags, _In_ bool forceSRGB, _Outptr_opt_ ID3D11Resource **texture, _Outptr_opt_ ID3D11ShaderResourceView **texture_view, _Out_opt_ DDS_ALPHA_MODE *alpha_mode=nullptr)
- HRESULT [CreateDDSTextureFromFileEx](#) (_In_ ID3D11Device2 *device, _In_opt_ ID3D11DeviceContext *device_context, _In_z_ const wchar_t *szFileName, _In_ size_t maxsize, _In_ D3D11_USAGE usage, _In_ uint32_t bindFlags, _In_ uint32_t cpu_access_flags, _In_ uint32_t misc_flags, _In_ bool forceSRGB, _Outptr_opt_ ID3D11Resource **texture, _Outptr_opt_ ID3D11ShaderResourceView **texture_view, _Out_opt_ DDS_ALPHA_MODE *alpha_mode=nullptr)
- SharedPtr< Texture > [CreateTexture](#) (const wstring &fname)
- SharedPtr< Texture > [CreateBlackTexture](#) ()
- SharedPtr< Texture > [CreateWhiteTexture](#) ()
- void [ImportTextureFromFile](#) (const wstring &fname, ID3D11Device2 *device, ID3D11ShaderResourceView **texture_srv)
- void [ComboBoxAdd](#) (HWND dialog, int id, const void *data, const wchar_t *desc)
- void [ComboBoxSelect](#) (HWND dialog, int id, int index)
- void [ComboBoxSelect](#) (HWND dialog, int id, const void *data)
- const void * [ComboBoxSelected](#) (HWND dialog, int id)
- bool [ComboBoxSomethingSelected](#) (HWND dialog, int id)
- int [ComboBoxCount](#) (HWND dialog, int id)
- bool [ComboBoxContains](#) (HWND dialog, int id, const wchar_t *desc)
- template<typename DataT>
void [ComboBoxAddData](#) (HWND dialog, int id, const DataT data, const wchar_t *desc)
- template<typename DataT>
void [ComboBoxSelectData](#) (HWND dialog, int id, const DataT data)
- template<typename DataT>
const DataT [ComboBoxSelectedData](#) (HWND dialog, int id)
- LRESULT CALLBACK [MainWindowProc](#) (HWND hWnd, UINT msg, WPARAM wParam, LPARAM lParam)

Variables

- [LoggingConfiguration g_logging_configuration](#)
- [Engine * g_engine = nullptr](#)
- [DeviceEnumeration * g_device_enumeration = nullptr](#)

- const D3D_FEATURE_LEVEL `g_feature_levels` []
- const DXGI_FORMAT `g_pixel_formats` []
- const char *const `mage_default_delimiters` = "\t\n\r"
- const uint32_t `DDS_MAGIC` = 0x20534444

4.1.1 Typedef Documentation

4.1.1.1 AmbientLightNode

```
typedef DerivedLightNode< AmbientLight > mage::AmbientLightNode
```

4.1.1.2 color

```
typedef XMFLOAT4 mage::color
```

4.1.1.3 ComPtr

```
template<typename T >
using mage::ComPtr = typedef Microsoft::WRL::ComPtr< T >
```

4.1.1.4 DirectionalLightNode

```
typedef DerivedLightNode< DirectionalLight > mage::DirectionalLightNode
```

4.1.1.5 float2

```
typedef XMFLOAT2 mage::float2
```

4.1.1.6 float3

```
typedef XMFLOAT3 mage::float3
```

4.1.1.7 float4

```
typedef XMFLOAT4 mage::float4
```

4.1.1.8 int2

```
typedef XMINT2 mage::int2
```

4.1.1.9 int3

```
typedef XMINT3 mage::int3
```

4.1.1.10 OmniLightNode

```
typedef DerivedLightNode< OmniLight > mage::OmniLightNode
```

4.1.1.11 OrthographicCameraNode

```
typedef DerivedCameraNode< OrthographicCamera > mage::OrthographicCameraNode
```

4.1.1.12 PerspectiveCameraNode

```
typedef DerivedCameraNode< PerspectiveCamera > mage::PerspectiveCameraNode
```

4.1.1.13 ResourceMap

```
template<typename KeyT , typename ResourceT >
using mage::ResourceMap = typedef map< KeyT, WeakPtr< ResourceT > >
```

A type definition for a resource map used by a resource pool.

Template Parameters

| | |
|------------------|--------------------|
| <i>KeyT</i> | The key type. |
| <i>ResourceT</i> | The resource type. |

4.1.1.14 SharedHandle

```
typedef SharedPtr< void > mage::SharedHandle
```

4.1.1.15 SharedPtr

```
template<typename T >
using mage::SharedPtr = typedef std::shared_ptr< T >
```

4.1.1.16 SpotLightNode

```
typedef DerivedLightNode< SpotLight > mage::SpotLightNode
```

4.1.1.17 UniqueFileStream

```
typedef std::unique_ptr< FILE, FileStreamCloser > mage::UniqueFileStream
```

4.1.1.18 UniqueHandle

```
typedef std::unique_ptr< void, HandleCloser > mage::UniqueHandle
```

4.1.1.19 UniquePtr

```
template<typename T >
using mage::UniquePtr = typedef std::unique_ptr< T >
```

4.1.1.20 WeakPtr

```
template<typename T >
using mage::WeakPtr = typedef std::weak_ptr< T >
```

4.1.2 Enumeration Type Documentation

4.1.2.1 DDS_ALPHA_MODE

```
enum mage::DDS_ALPHA_MODE
```

Enumerator

| |
|------------------------------|
| DDS_ALPHA_MODE_UNKNOWN |
| DDS_ALPHA_MODE_STRAIGHT |
| DDS_ALPHA_MODE_PREMULTIPLIED |
| DDS_ALPHA_MODE_OPAQUE |
| DDS_ALPHA_MODE_CUSTOM |

4.1.2.2 DDS_MISC_FLAGS2

```
enum mage::DDS_MISC_FLAGS2
```

Enumerator

| |
|---------------------------------|
| DDS_MISC_FLAGS2_ALPHA_MODE_MASK |
|---------------------------------|

4.1.2.3 ErrorDisposition

```
enum mage::ErrorDisposition
```

An enumeration of error dispositions.

This contains: `ERROR_DISPOSITION_IGNORE`, `ERROR_DISPOSITION_CONTINUE` and `ERROR_DISPOSITION_ABORT`.

Enumerator

| | |
|---|--|
| <code>ERROR_DISPOSITION_IGNORE</code> | |
| <code>ERROR_DISPOSITION_CONTINUE</code> | |
| <code>ERROR_DISPOSITION_ABORT</code> | |

4.1.2.4 `ReadWriteMutexLockType`

```
enum mage::ReadWriteMutexLockType
```

An enumeration of the different read write mutex lock types.

This contains: `ReadWriteMutexLockType_Read` and `ReadWriteMutexLockType_Write`.

Enumerator

| | |
|---|--|
| <code>ReadWriteMutexLockType_Read</code> | |
| <code>ReadWriteMutexLockType_Write</code> | |

4.1.2.5 `RotationAxes`

```
enum mage::RotationAxes
```

Enumerator

| | |
|--------------------------------------|--|
| <code>RotationAxes_MouseX</code> | |
| <code>RotationAxes_MouseY</code> | |
| <code>RotationAxes_MouseXAndY</code> | |

4.1.2.6 `SpriteEffect`

```
enum mage::SpriteEffect
```

An enumeration of the different sprite effects.

This contains: `SpriteEffect_None`, `SpriteEffect_FlipHorizontally`, `SpriteEffect_FlipVertically` and `SpriteEffect_FlipBoth`.

Enumerator

| | |
|--|--|
| <code>SpriteEffect_None</code> | |
| <code>SpriteEffect_FlipHorizontally</code> | |
| <code>SpriteEffect_FlipVertically</code> | |
| <code>SpriteEffect_FlipBoth</code> | |

4.1.2.7 SpriteSortMode

```
enum mage::SpriteSortMode
```

An enumeration of the different sprite sorting modes.

This contains: `SpriteSortMode_Deferred`, `SpriteSortMode_Immediate`, `SpriteSortMode_↔Texture`, `SpriteSortMode_BackToFront` and `SpriteSortMode_FrontToBack`.

Enumerator

| |
|---|
| <code>SpriteSortMode_Deferred</code> |
| <code>SpriteSortMode_Immediate</code> |
| <code>SpriteSortMode_↔Texture</code> |
| <code>SpriteSortMode_BackToFront</code> |
| <code>SpriteSortMode_FrontToBack</code> |

4.1.2.8 TokenResult

```
enum mage::TokenResult
```

An enumeration of the different token results.

This contains: `TokenResult_Valid`, `TokenResult_None` and `TokenResult_Invalid`.

Enumerator

| |
|----------------------------------|
| <code>TokenResult_Valid</code> |
| <code>TokenResult_None</code> |
| <code>TokenResult_Invalid</code> |

4.1.2.9 VariableType

```
enum mage::VariableType
```

An enumeration of the different (scripting) variable types.

This contains: `VariableType_Bool`, `VariableType_Int`, `VariableType_Int2`, `VariableType_↔Int3`, `VariableType_Float`, `VariableType_Float2`, `VariableType_Float3`, `VariableType_↔Float4`, `VariableType_Color` and `VariableType_String`.

Enumerator

| |
|----------------------------------|
| <code>VariableType_Bool</code> |
| <code>VariableType_Int</code> |
| <code>VariableType_Int2</code> |
| <code>VariableType_Int3</code> |
| <code>VariableType_Float</code> |
| <code>VariableType_Float2</code> |

Enumerator

| | |
|---------------------|--|
| VariableType_Float3 | |
| VariableType_Float4 | |
| VariableType_Color | |
| VariableType_String | |

4.1.3 Function Documentation**4.1.3.1 __declspec()**

```
mage::__declspec (
    align(16) ) [final]
```

A struct of light data buffers used by pixel shaders.

A struct of omni light buffers used by pixel shaders.

A struct of spotlight buffers used by pixel shaders.

A struct of transform buffers used by vertex shaders.

A struct of Cartesian axes systems.

A struct of sprite transforms.

A struct of transforms. Constructs a light data buffer.

Constructs a light data buffer from the given light data buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the light data buffer to copy. |
|----|--------|---|

Constructs a light data buffer by moving the given light data buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the light data buffer to move. |
|----|--------|---|

Destructs this light data buffer.

Copies the given light data buffer to this light data buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the light data buffer to copy. |
|----|--------|---|

Returns

A reference to the copy of the given light data buffer (i.e. this light data buffer).

Moves the given light data buffer to this light data buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the light data buffer to move. |
|----|---------------|---|

Returns

A reference to the moved light data buffer (i.e. this light data buffer).

The ambient light intensity of this light data buffer.

The number of omni lights of this light data buffer.

The intensity of the directional light of this light data buffer.

The number of spotlights of this light data buffer.

The (normalized) direction of the directional light in camera-space coordinates of this light data buffer.

The padding of this light data buffer.

Constructs an omni light buffer.

Constructs an omni light buffer from the given omni light buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the omni light buffer to copy. |
|----|---------------|---|

Constructs an omni light buffer by moving the given omni light buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the omni light buffer to move. |
|----|---------------|---|

Destructs this omni light buffer.

Copies the given omni light buffer to this omni light buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the omni light buffer to copy. |
|----|---------------|---|

Returns

A reference to the copy of the given omni light buffer (i.e. this omni light buffer).

Moves the given omni light buffer to this omni light buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the omni light buffer to move. |
|----|--------|---|

Returns

A reference to the moved omni light buffer (i.e. this omni light buffer).

The position of the omni light in camera-space coordinates of this omni light buffer.

The intensity of the omni light of this omni light buffer.

The start of the distance falloff of the omni light of this omni light buffer.

The end of the distance falloff of the omni light of this omni light buffer.

The padding of this omni light buffer.

Constructs a spotlight buffer.

Constructs a spotlight buffer from the given spotlight buffer.

Parameters

| | | |
|----|--------|--|
| in | buffer | A reference to the spotlight buffer to copy. |
|----|--------|--|

Constructs a spotlight buffer by moving the given spotlight buffer.

Parameters

| | | |
|----|--------|--|
| in | buffer | A reference to the spotlight buffer to move. |
|----|--------|--|

Destructs this spotlight buffer.

Copies the given spotlight buffer to this spotlight buffer.

Parameters

| | | |
|----|--------|--|
| in | buffer | A reference to the spotlight buffer to copy. |
|----|--------|--|

Returns

A reference to the copy of the given spotlight buffer (i.e. this spotlight buffer).

Moves the given spotlight buffer to this spotlight buffer.

Parameters

| | | |
|----|--------|--|
| in | buffer | A reference to the spotlight buffer to move. |
|----|--------|--|

Returns

A reference to the moved spotlight buffer (i.e. this spotlight buffer).

The position of the spotlight in camera-space coordinates of this spotlight buffer.

The intensity of the spotlight of this spotlight buffer.

The exponent property of the spotlight of this spotlight buffer.

The (normalized) direction of the spotlight in camera-space coordinates of this spotlight buffer.

The start of the distance falloff of the spotlight of this spotlight buffer.

The end of the distance falloff of the spotlight of this spotlight buffer.

The cosine of the penumbra angle of the spotlight of this spotlight buffer.

The cosine of the umbra angle of the spotlight of this spotlight buffer.

The padding of this spotlight buffer.

Constructs a transform buffer from the given camera transformation matrices.

Parameters

| | | |
|-----------------|---------------------------------|---|
| <code>in</code> | <code>world_to_view</code> | A reference to the (row-major) world-to-view matrix. |
| <code>in</code> | <code>view_to_projection</code> | A reference to the (row-major) view-to-projection matrix. |

Constructs a transform buffer from the given transform buffer.

Parameters

| | | |
|-----------------|---------------------|--|
| <code>in</code> | <code>buffer</code> | A reference to the transform buffer to copy. |
|-----------------|---------------------|--|

Constructs a transform buffer by moving the given transform buffer.

Parameters

| | | |
|-----------------|---------------------|--|
| <code>in</code> | <code>buffer</code> | A reference to the transform buffer to move. |
|-----------------|---------------------|--|

Destructs this transform buffer.

Copies the given transform buffer to this transform buffer.

Parameters

| | | |
|-----------------|---------------------|--|
| <code>in</code> | <code>buffer</code> | A reference to the transform buffer to copy. |
|-----------------|---------------------|--|

Returns

A reference to the copy of the given transform buffer (i.e. this transform buffer).

Moves the given transform buffer to this transform buffer.

Parameters

| | | |
|----|--------|--|
| in | buffer | A reference to the transform buffer to move. |
|----|--------|--|

Returns

A reference to the moved transform buffer (i.e. this transform buffer).

Returns the (row-major) world-to-view matrix of this transform buffer.

Returns

A reference to the (row-major) world-to-view matrix of this transform buffer.

Returns the (row-major) view-to-projection matrix of this transform buffer.

Returns

A reference to the (row-major) world-to-view matrix of this transform buffer.

Sets the object-specific matrices of this transform buffer.

Parameters

| | | |
|----|-----------------|--|
| in | object_to_world | A reference to the (row-major) object-world matrix. |
| in | view_to_object | A reference to the (row-major) view-to-object matrix (i.e. object-to-view inverse matrix). |

The (camera independent, object dependent) (column-major) object-to-world matrix of this transform buffer for use in HLSL.

The (camera dependent, object independent) (column-major) world-to-view matrix of this transform buffer for use in HLSL.

The (camera dependent, object dependent) (column-major) object-to-view inverse transpose matrix (for transforming object space normals) of this transform buffer for use in HLSL.

The (camera dependent, object independent) (column-major) view-to-projection matrix of this transform buffer for use in HLSL.

Constructs a Cartesian axes system.

Constructs a Cartesian axes system from the given axes.

Precondition

The given axis is normalized.

Parameters

| | | |
|----|---|----------------------------|
| in | x | A reference to the x-axis. |
|----|---|----------------------------|

Constructs a Cartesian axes system from the given axes.

Precondition

The given axes are orthonormal.

Parameters

| | | |
|----|---|----------------------------|
| in | x | A reference to the x-axis. |
| in | y | A reference to the y-axis. |

Constructs a Cartesian axes system from the given axes.

Precondition

The given axes are orthonormal.

Parameters

| | | |
|----|---|----------------------------|
| in | x | A reference to the x-axis. |
| in | y | A reference to the y-axis. |
| in | z | A reference to the z-axis. |

Constructs a Cartesian axes system from the given Cartesian axes system.

Parameters

| | | |
|----|------|---|
| in | axes | A reference to the Cartesian axes system to copy. |
|----|------|---|

Constructs a Cartesian axes system by moving the given Cartesian axes system.

Parameters

| | | |
|----|------|---|
| in | axes | A reference to the Cartesian axes system to move. |
|----|------|---|

Destructs this Cartesian axes system.

Copies the given Cartesian axes system to this Cartesian axes system.

Parameters

| | | |
|----|------|---|
| in | axes | A reference to the Cartesian axes system to copy. |
|----|------|---|

Returns

A reference to the copy of the given Cartesian axes system (i.e. this Cartesian axes system).

Moves the given Cartesian axes system to this Cartesian axes system.

Parameters

| | | |
|----|-------------|---|
| in | <i>axes</i> | A reference to the Cartesian axes system to move. |
|----|-------------|---|

Returns

A reference to the moved Cartesian axes system (i.e. this Cartesian axes system).

Returns the x-axis of this Cartesian axes system.

Returns

The x-axis of this Cartesian axes system.

Returns the y-axis of this Cartesian axes system.

Returns

The y-axis of this Cartesian axes system.

Returns the z-axis of this Cartesian axes system.

Returns

The z-axis of this Cartesian axes system.

The x-axis of this Cartesian axes system.

The y-axis of this Cartesian axes system.

The z-axis of this Cartesian axes system.

Constructs a sprite transform from the given translation, depth, rotation, rotation origin and scale component.

Parameters

| | | |
|----|------------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
| in | <i>depth</i> | The depth component. |
| in | <i>rotation</i> | The rotation component. |
| in | <i>rotation_origin</i> | A reference to the rotation component. |
| in | <i>scale</i> | A reference to the scale component. |

Constructs a sprite transform from the given translation, depth, rotation, rotation origin and scale component.

Parameters

| | | |
|----|------------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
| in | <i>depth</i> | The depth component. |
| in | <i>rotation</i> | The rotation component. |
| in | <i>rotation_origin</i> | A reference to the rotation component. |
| in | <i>scale</i> | A reference to the scale component. |

Constructs a sprite transform from the given sprite transform.

Parameters

| | | |
|----|------------------|--|
| in | <i>transform</i> | A reference to the sprite transform to copy. |
|----|------------------|--|

Constructs a sprite transform by moving the given sprite transform.

Parameters

| | | |
|----|------------------|--|
| in | <i>transform</i> | A reference to the sprite transform to move. |
|----|------------------|--|

Destructs this sprite transform.

Copies the given sprite transform to this sprite transform.

Parameters

| | | |
|----|------------------|-------------------------------|
| in | <i>transform</i> | The sprite transform to move. |
|----|------------------|-------------------------------|

Returns

A reference to the copy of the given sprite transform (i.e. this sprite transform).

Moves the given sprite transform to this sprite transform.

Parameters

| | | |
|----|------------------|-------------------------------|
| in | <i>transform</i> | The sprite transform to copy. |
|----|------------------|-------------------------------|

Returns

A reference to the moved sprite transform (i.e. this sprite transform).

Sets the x-value of the translation component of this sprite transform to the given value.

Parameters

| | | |
|----|----------|---|
| in | <i>x</i> | The x-value of the translation component. |
|----|----------|---|

Sets the y-value of the translation component of this sprite transform to the given value.

Parameters

| | | |
|----|----------|---|
| in | <i>y</i> | The y-value of the translation component. |
|----|----------|---|

Sets the translation component of this sprite transform to the given translation component.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the translation component. |
| in | y | The y-value of the translation component. |

Sets the translation component of this sprite transform to the given translation component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
|----|--------------------|---|

Sets the translation component of this sprite transform to the given translation component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
|----|--------------------|---|

Adds the given x-value to the translation component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the translation component to add. |
|----|---|--|

Adds the given y-value to the translation component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the translation component to add. |
|----|---|--|

Adds the given translation component to the translation component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the translation component to add. |
| in | y | The y-value of the translation component to add. |

Adds the given translation component to the translation component of this sprite transform.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the translation component to add. |
|----|--------------------|--|

Adds the given translation component to the translation component of this sprite transform.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the translation component to add. |
|----|--------------------|--|

Returns the x-value of the translation component of this sprite transform.

Returns

The x-value of the translation component of this sprite transform.

Returns the y-value of the translation component of this sprite transform.

Returns

The y-value of the translation component of this sprite transform.

Returns the translation component of this sprite transform.

Returns

The translation component of this sprite transform.

Sets the x-value of the translation component of this sprite transform to the given normalized value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the normalized translation component. |
|----|---|--|

Sets the y-value of the translation component of this sprite transform to the given normalized value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the normalized translation component. |
|----|---|--|

Sets the translation component of this sprite transform to the given normalized translation component.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the normalized translation component. |
| in | y | The y-value of the normalized translation component. |

Sets the translation component of this sprite transform to the given normalized translation component.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the normalized translation component. |
|----|--------------------|--|

Sets the translation component of this sprite transform to the given normalized translation component.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the normalized translation component. |
|----|--------------------|--|

Adds the given x-value to the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the normalized translation component to add. |
|----|---|---|

Adds the given y-value to the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | y | The y-value of the normalized translation component to add. |
|----|---|---|

Adds the given translation component to the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the normalized translation component to add. |
| in | y | The y-value of the normalized translation component to add. |

Adds the given translation component to the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the normalized translation component to add. |
|----|--------------------|---|

Adds the given translation component to the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the normalized translation component to add. |
|----|--------------------|---|

Returns the x-value of the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The x-value of the normalized translation component of this sprite transform.

Returns the y-value of the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The y-value of the normalized translation component of this sprite transform.

Returns the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The normalized translation component of this sprite transform.

Sets the depth component of this sprite transform to the given depth component.

Parameters

| | | |
|----|--------------|----------------------|
| in | <i>depth</i> | The depth component. |
|----|--------------|----------------------|

Adds the given depth component to the depth component of this sprite transform.

Parameters

| | | |
|----|--------------|-----------------------------|
| in | <i>depth</i> | The depth component to add. |
|----|--------------|-----------------------------|

Returns the depth component of this sprite transform.

Returns

The depth component of this sprite transform.

Sets the rotation component of this sprite transform to the given rotation component.

Parameters

| | | |
|----|-----------------|-------------------------|
| in | <i>rotation</i> | The rotation component. |
|----|-----------------|-------------------------|

Adds the given rotation component to the rotation component of this sprite transform.

Parameters

| | | |
|----|-----------------|--------------------------------|
| in | <i>rotation</i> | The rotation component to add. |
|----|-----------------|--------------------------------|

Returns the rotation component of this sprite transform.

Returns

The rotation component of this sprite transform.

Sets the x-value of the rotation origin of this sprite transform to the given value.

Parameters

| | | |
|----|----------|-------------------------------------|
| in | <i>x</i> | The x-value of the rotation origin. |
|----|----------|-------------------------------------|

Sets the y-value of the rotation origin of this sprite transform to the given value.

Parameters

| | | |
|----|----------|-------------------------------------|
| in | <i>y</i> | The y-value of the rotation origin. |
|----|----------|-------------------------------------|

Sets the rotation origin of this sprite transform to the given rotation origin.

Parameters

| | | |
|----|---|-------------------------------------|
| in | x | The x-value of the rotation origin. |
| in | y | The y-value of the rotation origin. |

Sets the rotation origin of this sprite transform to the given rotation origin.

Parameters

| | | |
|----|------------------------|-------------------------------------|
| in | <i>rotation_origin</i> | A reference to the rotation origin. |
|----|------------------------|-------------------------------------|

Sets the rotation origin of this sprite transform to the given rotation origin.

Parameters

| | | |
|----|------------------------|-------------------------------------|
| in | <i>rotation_origin</i> | A reference to the rotation origin. |
|----|------------------------|-------------------------------------|

Adds the given x-value to the rotation origin of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the rotation origin to add. |
|----|---|--|

Adds the given y-value to the rotation origin of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the rotation origin to add. |
|----|---|--|

Adds the given rotation origin to the rotation origin of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the rotation origin to add. |
| in | y | The y-value of the rotation origin to add. |

Adds the given rotation origin to the rotation origin of this sprite transform.

Parameters

| | | |
|----|------------------------|--|
| in | <i>rotation_origin</i> | A reference to the rotation origin to add. |
|----|------------------------|--|

Adds the given rotation origin to the rotation origin of this sprite transform.

Parameters

| | | |
|----|------------------------|--|
| in | <i>rotation_origin</i> | A reference to the rotation origin to add. |
|----|------------------------|--|

Returns the x-value of the rotation origin of this sprite transform.

Returns

The x-value of the rotation origin of this sprite transform.

Returns the y-value of the rotation origin of this sprite transform.

Returns

The y-value of the rotation origin of this sprite transform.

Returns the rotation origin of this sprite transform.

Returns

The rotation origin of this sprite transform.

Sets the x-value of the rotation origin of this sprite transform to the given normalized value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the normalized rotation origin. |
|----|---|--|

Sets the y-value of the rotation origin of this sprite transform to the given normalized value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the normalized rotation origin. |
|----|---|--|

Sets the rotation origin of this sprite transform to the given normalized rotation origin.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the normalized rotation origin. |
| in | y | The y-value of the normalized rotation origin. |

Sets the rotation origin of this sprite transform to the given normalized rotation origin.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|------------------------|--|
| in | <i>rotation_origin</i> | A reference to the normalized rotation origin. |
|----|------------------------|--|

Sets the rotation origin of this sprite transform to the given normalized rotation origin.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|------------------------|--|
| in | <i>rotation_origin</i> | A reference to the normalized rotation origin. |
|----|------------------------|--|

Adds the given x-value to the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the normalized rotation origin to add. |
|----|---|---|

Adds the given y-value to the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | y | The y-value of the normalized rotation origin to add. |
|----|---|---|

Adds the given rotation origin to the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the normalized rotation origin to add. |
| in | y | The y-value of the normalized rotation origin to add. |

Adds the given rotation origin to the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|------------------------|---|
| in | <i>rotation_origin</i> | A reference to the normalized rotation origin to add. |
|----|------------------------|---|

Adds the given rotation origin to the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|------------------------|---|
| in | <i>rotation_origin</i> | A reference to the normalized rotation origin to add. |
|----|------------------------|---|

Returns the x-value of the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The x-value of the normalized rotation origin of this sprite transform.

Returns the y-value of the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The y-value of the normalized rotation origin of this sprite transform.

Returns the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The normalized rotation origin of this sprite transform.

Sets the x-value of the scale component of this sprite transform to the given value.

Parameters

| | | |
|----|---|-------------------------------------|
| in | x | The x-value of the scale component. |
|----|---|-------------------------------------|

Sets the y-value of the scale component of this sprite transform to the given value.

Parameters

| | | |
|----|---|-------------------------------------|
| in | y | The y-value of the scale component. |
|----|---|-------------------------------------|

Sets the scale component of this sprite transform to the given scale component.

Parameters

| | | |
|----|---|----------------------|
| in | s | The scale component. |
|----|---|----------------------|

Sets the scale component of this sprite transform to the given scale component.

Parameters

| | | |
|----|---|-------------------------------------|
| in | x | The x-value of the scale component. |
| in | y | The y-value of the scale component. |

Sets the scale component of this sprite transform to the given scale component.

Parameters

| | | |
|----|-------|-------------------------------------|
| in | scale | A reference to the scale component. |
|----|-------|-------------------------------------|

Sets the scale component of this sprite transform to the given scale component.

Parameters

| | | |
|----|-------|-------------------------------------|
| in | scale | A reference to the scale component. |
|----|-------|-------------------------------------|

Adds the given x-value to the scale component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the scale component to add. |
|----|---|--|

Adds the given y-value to the scale component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the scale component to add. |
|----|---|--|

Adds the given scale component to the scale component of this sprite transform.

Parameters

| | | |
|----|---|-----------------------------|
| in | s | The scale component to add. |
|----|---|-----------------------------|

Adds the given scale component to the scale component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the scale component to add. |
| in | y | The y-value of the scale component to add. |

Adds the given scale component to the scale component of this sprite transform.

Parameters

| | | |
|----|-------|--|
| in | scale | A reference to the scale component to add. |
|----|-------|--|

Adds the given scale component to the scale component of this sprite transform.

Parameters

| | | |
|----|-------|--|
| in | scale | A reference to the scale component to add. |
|----|-------|--|

Returns the x-value of the scale component of this sprite transform.

Returns

The x-value of the scale component of this sprite transform.

Returns the y-value of the scale component of this sprite transform.

Returns

The y-value of the scale component of this sprite transform.

Returns the scale component of this sprite transform.

Returns

The scale component of this sprite transform.

The translation component of this sprite transform.

The depth component of this sprite transform.

The rotation component (in radians) of this sprite transform.

The rotation origin of this sprite transform.

The scale component of this sprite transform.

Constructs a transform from the given translation, rotation and scale component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
| in | <i>rotation</i> | A reference to the rotation component. |
| in | <i>scale</i> | A reference to the scale component. |

Constructs a transform from the given translation, rotation and scale component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
| in | <i>rotation</i> | A reference to the rotation component. |
| in | <i>scale</i> | A reference to the scale component. |

Constructs a transform from the given transform.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>transform</i> | A reference to the transform to copy. |
|----|------------------|---------------------------------------|

Constructs a transform by moving the given transform.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>transform</i> | A reference to the transform to move. |
|----|------------------|---------------------------------------|

Destructs this transform.

Copies the given transform to this transform.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>transform</i> | A reference to the transform to copy. |
|----|------------------|---------------------------------------|

Returns

A reference to the copy of the given transform (i.e. this transform).

Moves the given transform to this transform.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>transform</i> | A reference to the transform to move. |
|----|------------------|---------------------------------------|

Returns

A reference to the moved transform (i.e. this transform).

Sets the x-value of the translation component of this transform to the given value.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the translation component. |
|----|---|---|

Sets the y-value of the translation component of this transform to the given value.

Parameters

| | | |
|----|---|---|
| in | y | The y-value of the translation component. |
|----|---|---|

Sets the z-value of the translation component of this transform to the given value.

Parameters

| | | |
|----|---|---|
| in | z | The z-value of the translation component. |
|----|---|---|

Sets the translation component of this transform to the given translation component.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the translation component. |
| in | y | The y-value of the translation component. |
| in | z | The z-value of the translation component. |

Sets the translation component of this transform to the given translation component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
|----|--------------------|---|

Sets the translation component of this transform to the given translation component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
|----|--------------------|---|

Adds the given x-value to the translation component of this transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the translation component to add. |
|----|---|--|

Adds the given y-value to the translation component of this transform.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the translation component to add. |
|----|---|--|

Adds the given z-value to the translation component of this transform.

Parameters

| | | |
|----|----------|--|
| in | <i>z</i> | The z-value of the translation component to add. |
|----|----------|--|

Adds the given translation component to the translation component of this transform.

Parameters

| | | |
|----|----------|--|
| in | <i>x</i> | The x-value of the translation component to add. |
| in | <i>y</i> | The y-value of the translation component to add. |
| in | <i>z</i> | The z-value of the translation component to add. |

Adds the given translation component to the translation component of this transform.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the translation component to add. |
|----|--------------------|--|

Adds the given translation component to the translation component of this transform.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the translation component to add. |
|----|--------------------|--|

Returns the x-value of the translation component of this transform.

Returns

The x-value of the translation component of this transform.

Returns the y-value of the translation component of this transform.

Returns

The y-value of the translation component of this transform.

Returns the z-value of the translation component of this transform.

Returns

The z-value of the translation component of this transform.

Returns the translation component of this transform.

Returns

The translation component of this transform.

Returns the object-to-parent translation matrix of this transform.

Returns

The object-to-parent translation matrix of this transform.

Returns the parent-to-object translation matrix of this transform.

Returns

The parent-to-object translation matrix of this transform.

Sets the x-value of the rotation component of this transform to the given value.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the rotation component. |
|----|---|--|

Sets the y-value of the rotation component of this transform to the given value.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the rotation component. |
|----|---|--|

Sets the z-value of the rotation component of this transform to the given value.

Parameters

| | | |
|----|---|--|
| in | z | The z-value of the rotation component. |
|----|---|--|

Sets the rotation component of this transform to the given rotation component.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the rotation component. |
| in | y | The y-value of the rotation component. |
| in | z | The z-value of the rotation component. |

Sets the rotation component of this transform to the given rotation component.

Parameters

| | | |
|----|----------|--|
| in | rotation | A reference to the rotation component. |
|----|----------|--|

Sets the rotation component of this transform to the given rotation component.

Parameters

| | | |
|----|----------|--|
| in | rotation | A reference to the rotation component. |
|----|----------|--|

Sets the rotation component to a rotation of the given angle around the given normal.

Parameters

| | | |
|----|---------------|----------------------------|
| in | <i>normal</i> | A reference to the normal. |
| in | <i>angle</i> | The angle. |

Adds the given x-value to the rotation component of this transform.

Parameters

| | | |
|----|----------|---|
| in | <i>x</i> | The x-value of the rotation component to add. |
|----|----------|---|

Adds the given y-value to the rotation component of this transform.

Parameters

| | | |
|----|----------|---|
| in | <i>y</i> | The y-value of the rotation component to add. |
|----|----------|---|

Adds the given z-value to the rotation component of this transform.

Parameters

| | | |
|----|----------|---|
| in | <i>z</i> | The z-value of the rotation component to add. |
|----|----------|---|

Adds the given rotation component to the rotation component of this transform.

Parameters

| | | |
|----|----------|---|
| in | <i>x</i> | The x-value of the rotation component to add. |
| in | <i>y</i> | The y-value of the rotation component to add. |
| in | <i>z</i> | The z-value of the rotation component to add. |

Adds the given rotation component to the rotation component of this transform.

Parameters

| | | |
|----|-----------------|---|
| in | <i>rotation</i> | A reference to the rotation component to add. |
|----|-----------------|---|

Adds the given rotation component to the rotation component of this transform.

Parameters

| | | |
|----|-----------------|---|
| in | <i>rotation</i> | A reference to the rotation component to add. |
|----|-----------------|---|

Returns the x-value of the rotation component of this transform.

Returns

The x-value of the rotation component of this transform.

Returns the y-value of the rotation component of this transform.

Returns

The y-value of the rotation component of this transform.

Returns the z-value of the rotation component of this transform.

Returns

The z-value of the rotation component of this transform.

Returns the rotation component of this transform.

Returns

The rotation component of this transform.

Returns the object-to-parent rotation matrix of this transform.

Returns

The object-to-parent rotation matrix of this transform.

Returns the parent-to-object rotation matrix of this transform.

Returns

The parent-to-object rotation matrix of this transform.

Sets the x-value of the scale component of this transform to the given value.

Parameters

| | | |
|----|---|-------------------------------------|
| in | x | The x-value of the scale component. |
|----|---|-------------------------------------|

Sets the y-value of the scale component of this transform to the given value.

Parameters

| | | |
|----|---|-------------------------------------|
| in | y | The y-value of the scale component. |
|----|---|-------------------------------------|

Sets the z-value of the scale component of this transform to the given value.

Parameters

| | | |
|----|---|-------------------------------------|
| in | z | The z-value of the scale component. |
|----|---|-------------------------------------|

Sets the scale component of this transform to the given scale component.

Parameters

| | | |
|----|---|----------------------|
| in | s | The scale component. |
|----|---|----------------------|

Sets the scale component of this transform to the given scale component.

Parameters

| | | |
|----|---|-------------------------------------|
| in | x | The x-value of the scale component. |
| in | y | The y-value of the scale component. |
| in | z | The z-value of the scale component. |

Sets the scale component of this transform to the given scale component.

Parameters

| | | |
|----|-------|-------------------------------------|
| in | scale | A reference to the scale component. |
|----|-------|-------------------------------------|

Sets the scale component of this transform to the given scale component.

Parameters

| | | |
|----|-------|-------------------------------------|
| in | scale | A reference to the scale component. |
|----|-------|-------------------------------------|

Adds the given x-value to the scale component of this transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the scale component to add. |
|----|---|--|

Adds the given y-value to the scale component of this transform.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the scale component to add. |
|----|---|--|

Adds the given z-value to the scale component of this transform.

Parameters

| | | |
|----|---|--|
| in | z | The z-value of the scale component to add. |
|----|---|--|

Adds the given scale component to the scale component of this transform.

Parameters

| | | |
|----|---|-----------------------------|
| in | s | The scale component to add. |
|----|---|-----------------------------|

Adds the given scale component to the scale component of this transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the scale component to add. |
| in | y | The y-value of the scale component to add. |
| in | z | The z-value of the scale component to add. |

Adds the given scale component to the scale component of this transform.

Parameters

| | | |
|----|-------|--|
| in | scale | A reference to the scale component to add. |
|----|-------|--|

Adds the given scale component to the scale component of this transform.

Parameters

| | | |
|----|-------|--|
| in | scale | A reference to the scale component to add. |
|----|-------|--|

Returns the x-value of the scale component of this transform.

Returns

The x-value of the scale component of this transform.

Returns the y-value of the scale component of this transform.

Returns

The y-value of the scale component of this transform.

Returns the z-value of the scale component of this transform.

Returns

The z-value of the scale component of this transform.

Returns the scale component of this transform.

Returns

The scale component of this transform.

Returns the object-to-parent scale matrix of this transform.

Returns

The scale object-to-parent matrix of this transform.

Returns the parent-to-object scale matrix of this transform.

Returns

The parent-to-object scale matrix of this transform.

Returns the position of the local origin of this transform expressed in object space coordinates.

Returns

The position of the local origin of this transform expressed in object space coordinates.

Returns the direction of the local x-axis of this transform expressed in object space coordinates.

Returns

The direction of the local x-axis of this transform expressed in object space coordinates.

Returns the direction of the local y-axis of this transform expressed in object space coordinates.

Returns

The direction of the local y-axis of this transform expressed in object space coordinates.

Returns the direction of the local z-axis of this transform expressed in object space coordinates.

Returns

The direction of the local z-axis of this transform expressed in object space coordinates.

Returns the local Cartesian axes system of this transform in object space coordinates.

Returns

The local Cartesian axes system of this transform expressed in object space coordinates.

Returns the local Cartesian coordinate system of this transform in object space coordinates.

Returns

The local Cartesian coordinate system of this transform expressed in object space coordinates.

Returns the position of the local origin of this transform expressed in parent space coordinates.

Returns

The position of the local origin of this transform expressed in parent space coordinates.

Returns the direction of the local x-axis of this transform expressed in parent space coordinates.

Returns

The direction of the local x-axis of this transform expressed in parent space coordinates.

Returns the direction of the local y-axis of this transform expressed in parent space coordinates.

Returns

The direction of the local y-axis of this transform expressed in parent space coordinates.

Returns the direction of the local z-axis of this transform expressed in parent space coordinates.

Returns

The direction of the local z-axis of this transform expressed in parent space coordinates.

Returns the local Cartesian axes system of this transform expressed in parent space coordinates.

Returns

The local Cartesian axes system of this transform expressed in parent space coordinates.

Returns the local Cartesian coordinate system of this transform in parent space coordinates.

Returns

The local Cartesian coordinate system of this transform expressed in parent space coordinates.

Returns the object-to-parent matrix of this transform.

Returns

The object-to-parent matrix of this transform.

Returns the parent-to-object matrix of this transform.

Returns

The parent-to-object matrix of this transform.

Transforms the given vector expressed in object space coordinates to parent space coordinates.

Parameters

| | | |
|----|---------------|--|
| in | <i>vector</i> | A reference to the vector expressed in object space coordinates. |
|----|---------------|--|

Returns

The transformed vector expressed in parent space coordinates.

Transforms the given vector expressed in parent space coordinates to object space coordinates.

Parameters

| | | |
|----|---------------|--|
| in | <i>vector</i> | A reference to the vector expressed in parent space coordinates. |
|----|---------------|--|

Returns

The transformed vector expressed in object space coordinates.

Transforms the given direction expressed in object space coordinates to parent space coordinates.

Parameters

| | | |
|----|------------------|---|
| in | <i>direction</i> | A reference to the direction expressed in object space coordinates. |
|----|------------------|---|

Returns

The transformed (normalized) direction expressed in parent space coordinates.

Sets this transform to dirty.

Updates the object-to-parent matrix of this transform if dirty.

Updates the parent-to-object matrix of this transform if dirty.

The translation component of this transform.

The rotation component (in radians) of this transform.

The scale component of this transform.

The cached object-to-parent matrix of this transform.

The cached parent-to-object matrix of this transform.

A flag indicating whether the object-to-parent matrix of this transform node are dirty.

A flag indicating whether the parent-to-object matrix of this transform node are dirty.

A flag indicating how the back buffers should be rotated to fit the physical rotation of a monitor.

A flag (indicating whether the viewport of this sprite batch has been set.

The viewport of this sprite batch.

Constructs an omni light buffer.

Constructs an omni light buffer from the given omni light buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the omni light buffer to copy. |
|----|---------------|---|

Constructs an omni light buffer by moving the given omni light buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the omni light buffer to move. |
|----|---------------|---|

Destructs this omni light buffer.

Copies the given omni light buffer to this omni light buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the omni light buffer to copy. |
|----|--------|---|

Returns

A reference to the copy of the given omni light buffer (i.e. this omni light buffer).

Moves the given omni light buffer to this omni light buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the omni light buffer to move. |
|----|--------|---|

Returns

A reference to the moved omni light buffer (i.e. this omni light buffer).

The position of the omni light in camera-space coordinates of this omni light buffer.

The intensity of the omni light of this omni light buffer.

The start of the distance falloff of the omni light of this omni light buffer.

The end of the distance falloff of the omni light of this omni light buffer.

The padding of this omni light buffer.

Constructs a spotlight buffer.

Constructs a spotlight buffer from the given spotlight buffer.

Parameters

| | | |
|----|--------|--|
| in | buffer | A reference to the spotlight buffer to copy. |
|----|--------|--|

Constructs a spotlight buffer by moving the given spotlight buffer.

Parameters

| | | |
|----|--------|--|
| in | buffer | A reference to the spotlight buffer to move. |
|----|--------|--|

Destructs this spotlight buffer.

Copies the given spotlight buffer to this spotlight buffer.

Parameters

| | | |
|-----------------|---------------------|--|
| <code>in</code> | <code>buffer</code> | A reference to the spotlight buffer to copy. |
|-----------------|---------------------|--|

Returns

A reference to the copy of the given spotlight buffer (i.e. this spotlight buffer).

Moves the given spotlight buffer to this spotlight buffer.

Parameters

| | | |
|-----------------|---------------------|--|
| <code>in</code> | <code>buffer</code> | A reference to the spotlight buffer to move. |
|-----------------|---------------------|--|

Returns

A reference to the moved spotlight buffer (i.e. this spotlight buffer).

The position of the spotlight in camera-space coordinates of this spotlight buffer.

The intensity of the spotlight of this spotlight buffer.

The exponent property of the spotlight of this spotlight buffer.

The (normalized) direction of the spotlight in camera-space coordinates of this spotlight buffer.

The start of the distance falloff of the spotlight of this spotlight buffer.

The end of the distance falloff of the spotlight of this spotlight buffer.

The cosine of the penumbra angle of the spotlight of this spotlight buffer.

The cosine of the umbra angle of the spotlight of this spotlight buffer.

The padding of this spotlight buffer.

Constructs a transform buffer from the given camera transformation matrices.

Parameters

| | | |
|-----------------|---------------------------------|---|
| <code>in</code> | <code>world_to_view</code> | A reference to the (row-major) world-to-view matrix. |
| <code>in</code> | <code>view_to_projection</code> | A reference to the (row-major) view-to-projection matrix. |

Constructs a transform buffer from the given transform buffer.

Parameters

| | | |
|-----------------|---------------------|--|
| <code>in</code> | <code>buffer</code> | A reference to the transform buffer to copy. |
|-----------------|---------------------|--|

Constructs a transform buffer by moving the given transform buffer.

Parameters

| | | |
|----|--------|--|
| in | buffer | A reference to the transform buffer to move. |
|----|--------|--|

Destructs this transform buffer.

Copies the given transform buffer to this transform buffer.

Parameters

| | | |
|----|--------|--|
| in | buffer | A reference to the transform buffer to copy. |
|----|--------|--|

Returns

A reference to the copy of the given transform buffer (i.e. this transform buffer).

Moves the given transform buffer to this transform buffer.

Parameters

| | | |
|----|--------|--|
| in | buffer | A reference to the transform buffer to move. |
|----|--------|--|

Returns

A reference to the moved transform buffer (i.e. this transform buffer).

Returns the (row-major) world-to-view matrix of this transform buffer.

Returns

A reference to the (row-major) world-to-view matrix of this transform buffer.

Returns the (row-major) view-to-projection matrix of this transform buffer.

Returns

A reference to the (row-major) world-to-view matrix of this transform buffer.

Sets the object-specific matrices of this transform buffer.

Parameters

| | | |
|----|-----------------|--|
| in | object_to_world | A reference to the (row-major) object-world matrix. |
| in | view_to_object | A reference to the (row-major) view-to-object matrix (i.e. object-to-view inverse matrix). |

The (camera independent, object dependent) (column-major) object-to-world matrix of this transform buffer for use in HLSL.

The (camera dependent, object independent) (column-major) world-to-view matrix of this transform buffer for use in HLSL.

The (camera dependent, object dependent) (column-major) object-to-view inverse transpose matrix (for transforming object space normals) of this transform buffer for use in HLSL.

The (camera dependent, object independent) (column-major) view-to-projection matrix of this transform buffer for use in HLSL.

Constructs a Cartesian axes system.

Constructs a Cartesian axes system from the given axes.

Precondition

The given axis is normalized.

Parameters

| | | |
|----|---|----------------------------|
| in | x | A reference to the x-axis. |
|----|---|----------------------------|

Constructs a Cartesian axes system from the given axes.

Precondition

The given axes are orthonormal.

Parameters

| | | |
|----|---|----------------------------|
| in | x | A reference to the x-axis. |
| in | y | A reference to the y-axis. |

Constructs a Cartesian axes system from the given axes.

Precondition

The given axes are orthonormal.

Parameters

| | | |
|----|---|----------------------------|
| in | x | A reference to the x-axis. |
| in | y | A reference to the y-axis. |
| in | z | A reference to the z-axis. |

Constructs a Cartesian axes system from the given Cartesian axes system.

Parameters

| | | |
|----|------|---|
| in | axes | A reference to the Cartesian axes system to copy. |
|----|------|---|

Constructs a Cartesian axes system by moving the given Cartesian axes system.

Parameters

| | | |
|----|------|---|
| in | axes | A reference to the Cartesian axes system to move. |
|----|------|---|

Destructs this Cartesian axes system.

Copies the given Cartesian axes system to this Cartesian axes system.

Parameters

| | | |
|----|------|---|
| in | axes | A reference to the Cartesian axes system to copy. |
|----|------|---|

Returns

A reference to the copy of the given Cartesian axes system (i.e. this Cartesian axes system).

Moves the given Cartesian axes system to this Cartesian axes system.

Parameters

| | | |
|----|------|---|
| in | axes | A reference to the Cartesian axes system to move. |
|----|------|---|

Returns

A reference to the moved Cartesian axes system (i.e. this Cartesian axes system).

Returns the x-axis of this Cartesian axes system.

Returns

The x-axis of this Cartesian axes system.

Returns the y-axis of this Cartesian axes system.

Returns

The y-axis of this Cartesian axes system.

Returns the z-axis of this Cartesian axes system.

Returns

The z-axis of this Cartesian axes system.

The x-axis of this Cartesian axes system.

The y-axis of this Cartesian axes system.

The z-axis of this Cartesian axes system.

Constructs a sprite transform from the given translation, depth, rotation, rotation origin and scale component.

Parameters

| | | |
|----|------------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
| in | <i>depth</i> | The depth component. |
| in | <i>rotation</i> | The rotation component. |
| in | <i>rotation_origin</i> | A reference to the rotation component. |
| in | <i>scale</i> | A reference to the scale component. |

Constructs a sprite transform from the given translation, depth, rotation, rotation origin and scale component.

Parameters

| | | |
|----|------------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
| in | <i>depth</i> | The depth component. |
| in | <i>rotation</i> | The rotation component. |
| in | <i>rotation_origin</i> | A reference to the rotation component. |
| in | <i>scale</i> | A reference to the scale component. |

Constructs a sprite transform from the given sprite transform.

Parameters

| | | |
|----|------------------|--|
| in | <i>transform</i> | A reference to the sprite transform to copy. |
|----|------------------|--|

Constructs a sprite transform by moving the given sprite transform.

Parameters

| | | |
|----|------------------|--|
| in | <i>transform</i> | A reference to the sprite transform to move. |
|----|------------------|--|

Destructs this sprite transform.

Copies the given sprite transform to this sprite transform.

Parameters

| | | |
|----|------------------|-------------------------------|
| in | <i>transform</i> | The sprite transform to move. |
|----|------------------|-------------------------------|

Returns

A reference to the copy of the given sprite transform (i.e. this sprite transform).

Moves the given sprite transform to this sprite transform.

Parameters

| | | |
|----|------------------|-------------------------------|
| in | <i>transform</i> | The sprite transform to copy. |
|----|------------------|-------------------------------|

Returns

A reference to the moved sprite transform (i.e. this sprite transform).

Sets the x-value of the translation component of this sprite transform to the given value.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the translation component. |
|----|---|---|

Sets the y-value of the translation component of this sprite transform to the given value.

Parameters

| | | |
|----|---|---|
| in | y | The y-value of the translation component. |
|----|---|---|

Sets the translation component of this sprite transform to the given translation component.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the translation component. |
| in | y | The y-value of the translation component. |

Sets the translation component of this sprite transform to the given translation component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
|----|--------------------|---|

Sets the translation component of this sprite transform to the given translation component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
|----|--------------------|---|

Adds the given x-value to the translation component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the translation component to add. |
|----|---|--|

Adds the given y-value to the translation component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the translation component to add. |
|----|---|--|

Adds the given translation component to the translation component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the translation component to add. |
| in | y | The y-value of the translation component to add. |

Adds the given translation component to the translation component of this sprite transform.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the translation component to add. |
|----|--------------------|--|

Adds the given translation component to the translation component of this sprite transform.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the translation component to add. |
|----|--------------------|--|

Returns the x-value of the translation component of this sprite transform.

Returns

The x-value of the translation component of this sprite transform.

Returns the y-value of the translation component of this sprite transform.

Returns

The y-value of the translation component of this sprite transform.

Returns the translation component of this sprite transform.

Returns

The translation component of this sprite transform.

Sets the x-value of the translation component of this sprite transform to the given normalized value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the normalized translation component. |
|----|---|--|

Sets the y-value of the translation component of this sprite transform to the given normalized value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the normalized translation component. |
|----|---|--|

Sets the translation component of this sprite transform to the given normalized translation component.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the normalized translation component. |
| in | y | The y-value of the normalized translation component. |

Sets the translation component of this sprite transform to the given normalized translation component.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the normalized translation component. |
|----|--------------------|--|

Sets the translation component of this sprite transform to the given normalized translation component.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the normalized translation component. |
|----|--------------------|--|

Adds the given x-value to the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the normalized translation component to add. |
|----|---|---|

Adds the given y-value to the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | y | The y-value of the normalized translation component to add. |
|----|---|---|

Adds the given translation component to the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the normalized translation component to add. |
| in | y | The y-value of the normalized translation component to add. |

Adds the given translation component to the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the normalized translation component to add. |
|----|--------------------|---|

Adds the given translation component to the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the normalized translation component to add. |
|----|--------------------|---|

Returns the x-value of the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The x-value of the normalized translation component of this sprite transform.

Returns the y-value of the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The y-value of the normalized translation component of this sprite transform.

Returns the normalized translation component of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The normalized translation component of this sprite transform.

Sets the depth component of this sprite transform to the given depth component.

Parameters

| | | |
|----|--------------|----------------------|
| in | <i>depth</i> | The depth component. |
|----|--------------|----------------------|

Adds the given depth component to the depth component of this sprite transform.

Parameters

| | | |
|----|--------------|-----------------------------|
| in | <i>depth</i> | The depth component to add. |
|----|--------------|-----------------------------|

Returns the depth component of this sprite transform.

Returns

The depth component of this sprite transform.

Sets the rotation component of this sprite transform to the given rotation component.

Parameters

| | | |
|----|-----------------|-------------------------|
| in | <i>rotation</i> | The rotation component. |
|----|-----------------|-------------------------|

Adds the given rotation component to the rotation component of this sprite transform.

Parameters

| | | |
|----|-----------------|--------------------------------|
| in | <i>rotation</i> | The rotation component to add. |
|----|-----------------|--------------------------------|

Returns the rotation component of this sprite transform.

Returns

The rotation component of this sprite transform.

Sets the x-value of the rotation origin of this sprite transform to the given value.

Parameters

| | | |
|----|----------|-------------------------------------|
| in | <i>x</i> | The x-value of the rotation origin. |
|----|----------|-------------------------------------|

Sets the y-value of the rotation origin of this sprite transform to the given value.

Parameters

| | | |
|----|----------|-------------------------------------|
| in | <i>y</i> | The y-value of the rotation origin. |
|----|----------|-------------------------------------|

Sets the rotation origin of this sprite transform to the given rotation origin.

Parameters

| | | |
|----|----------|-------------------------------------|
| in | <i>x</i> | The x-value of the rotation origin. |
| in | <i>y</i> | The y-value of the rotation origin. |

Sets the rotation origin of this sprite transform to the given rotation origin.

Parameters

| | | |
|----|------------------------|-------------------------------------|
| in | <i>rotation_origin</i> | A reference to the rotation origin. |
|----|------------------------|-------------------------------------|

Sets the rotation origin of this sprite transform to the given rotation origin.

Parameters

| | | |
|----|------------------------|-------------------------------------|
| in | <i>rotation_origin</i> | A reference to the rotation origin. |
|----|------------------------|-------------------------------------|

Adds the given x-value to the rotation origin of this sprite transform.

Parameters

| | | |
|----|----------|--|
| in | <i>x</i> | The x-value of the rotation origin to add. |
|----|----------|--|

Adds the given y-value to the rotation origin of this sprite transform.

Parameters

| | | |
|----|----------|--|
| in | <i>y</i> | The y-value of the rotation origin to add. |
|----|----------|--|

Adds the given rotation origin to the rotation origin of this sprite transform.

Parameters

| | | |
|----|----------|--|
| in | <i>x</i> | The x-value of the rotation origin to add. |
| in | <i>y</i> | The y-value of the rotation origin to add. |

Adds the given rotation origin to the rotation origin of this sprite transform.

Parameters

| | | |
|----|------------------------|--|
| in | <i>rotation_origin</i> | A reference to the rotation origin to add. |
|----|------------------------|--|

Adds the given rotation origin to the rotation origin of this sprite transform.

Parameters

| | | |
|----|------------------------|--|
| in | <i>rotation_origin</i> | A reference to the rotation origin to add. |
|----|------------------------|--|

Returns the x-value of the rotation origin of this sprite transform.

Returns

The x-value of the rotation origin of this sprite transform.

Returns the y-value of the rotation origin of this sprite transform.

Returns

The y-value of the rotation origin of this sprite transform.

Returns the rotation origin of this sprite transform.

Returns

The rotation origin of this sprite transform.

Sets the x-value of the rotation origin of this sprite transform to the given normalized value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the normalized rotation origin. |
|----|---|--|

Sets the y-value of the rotation origin of this sprite transform to the given normalized value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the normalized rotation origin. |
|----|---|--|

Sets the rotation origin of this sprite transform to the given normalized rotation origin.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the normalized rotation origin. |
| in | y | The y-value of the normalized rotation origin. |

Sets the rotation origin of this sprite transform to the given normalized rotation origin.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|------------------------|--|
| in | <i>rotation_origin</i> | A reference to the normalized rotation origin. |
|----|------------------------|--|

Sets the rotation origin of this sprite transform to the given normalized rotation origin.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|------------------------|--|
| in | <i>rotation_origin</i> | A reference to the normalized rotation origin. |
|----|------------------------|--|

Adds the given x-value to the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the normalized rotation origin to add. |
|----|---|---|

Adds the given y-value to the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | y | The y-value of the normalized rotation origin to add. |
|----|---|---|

Adds the given rotation origin to the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the normalized rotation origin to add. |
| in | y | The y-value of the normalized rotation origin to add. |

Adds the given rotation origin to the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|------------------------|---|
| in | <i>rotation_origin</i> | A reference to the normalized rotation origin to add. |
|----|------------------------|---|

Adds the given rotation origin to the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|------------------------|---|
| in | <i>rotation_origin</i> | A reference to the normalized rotation origin to add. |
|----|------------------------|---|

Returns the x-value of the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The x-value of the normalized rotation origin of this sprite transform.

Returns the y-value of the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The y-value of the normalized rotation origin of this sprite transform.

Returns the normalized rotation origin of this sprite transform.

Precondition

The current engine must be loaded.

Returns

The normalized rotation origin of this sprite transform.

Sets the x-value of the scale component of this sprite transform to the given value.

Parameters

| | | |
|----|---|-------------------------------------|
| in | x | The x-value of the scale component. |
|----|---|-------------------------------------|

Sets the y-value of the scale component of this sprite transform to the given value.

Parameters

| | | |
|----|---|-------------------------------------|
| in | y | The y-value of the scale component. |
|----|---|-------------------------------------|

Sets the scale component of this sprite transform to the given scale component.

Parameters

| | | |
|----|---|----------------------|
| in | s | The scale component. |
|----|---|----------------------|

Sets the scale component of this sprite transform to the given scale component.

Parameters

| | | |
|----|---|-------------------------------------|
| in | x | The x-value of the scale component. |
| in | y | The y-value of the scale component. |

Sets the scale component of this sprite transform to the given scale component.

Parameters

| | | |
|----|-------|-------------------------------------|
| in | scale | A reference to the scale component. |
|----|-------|-------------------------------------|

Sets the scale component of this sprite transform to the given scale component.

Parameters

| | | |
|----|-------|-------------------------------------|
| in | scale | A reference to the scale component. |
|----|-------|-------------------------------------|

Adds the given x-value to the scale component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the scale component to add. |
|----|---|--|

Adds the given y-value to the scale component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the scale component to add. |
|----|---|--|

Adds the given scale component to the scale component of this sprite transform.

Parameters

| | | |
|----|---|-----------------------------|
| in | s | The scale component to add. |
|----|---|-----------------------------|

Adds the given scale component to the scale component of this sprite transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the scale component to add. |
| in | y | The y-value of the scale component to add. |

Adds the given scale component to the scale component of this sprite transform.

Parameters

| | | |
|----|-------|--|
| in | scale | A reference to the scale component to add. |
|----|-------|--|

Adds the given scale component to the scale component of this sprite transform.

Parameters

| | | |
|----|--------------|--|
| in | <i>scale</i> | A reference to the scale component to add. |
|----|--------------|--|

Returns the x-value of the scale component of this sprite transform.

Returns

The x-value of the scale component of this sprite transform.

Returns the y-value of the scale component of this sprite transform.

Returns

The y-value of the scale component of this sprite transform.

Returns the scale component of this sprite transform.

Returns

The scale component of this sprite transform.

The translation component of this sprite transform.

The depth component of this sprite transform.

The rotation component (in radians) of this sprite transform.

The rotation origin of this sprite transform.

The scale component of this sprite transform.

Constructs a transform from the given translation, rotation and scale component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
| in | <i>rotation</i> | A reference to the rotation component. |
| in | <i>scale</i> | A reference to the scale component. |

Constructs a transform from the given translation, rotation and scale component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
| in | <i>rotation</i> | A reference to the rotation component. |
| in | <i>scale</i> | A reference to the scale component. |

Constructs a transform from the given transform.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>transform</i> | A reference to the transform to copy. |
|----|------------------|---------------------------------------|

Constructs a transform by moving the given transform.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>transform</i> | A reference to the transform to move. |
|----|------------------|---------------------------------------|

Destructs this transform.

Copies the given transform to this transform.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>transform</i> | A reference to the transform to copy. |
|----|------------------|---------------------------------------|

Returns

A reference to the copy of the given transform (i.e. this transform).

Moves the given transform to this transform.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>transform</i> | A reference to the transform to move. |
|----|------------------|---------------------------------------|

Returns

A reference to the moved transform (i.e. this transform).

Sets the x-value of the translation component of this transform to the given value.

Parameters

| | | |
|----|----------|---|
| in | <i>x</i> | The x-value of the translation component. |
|----|----------|---|

Sets the y-value of the translation component of this transform to the given value.

Parameters

| | | |
|----|----------|---|
| in | <i>y</i> | The y-value of the translation component. |
|----|----------|---|

Sets the z-value of the translation component of this transform to the given value.

Parameters

| | | |
|----|----------|---|
| in | <i>z</i> | The z-value of the translation component. |
|----|----------|---|

Sets the translation component of this transform to the given translation component.

Parameters

| | | |
|----|----------|---|
| in | <i>x</i> | The x-value of the translation component. |
| in | <i>y</i> | The y-value of the translation component. |
| in | <i>z</i> | The z-value of the translation component. |

Sets the translation component of this transform to the given translation component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
|----|--------------------|---|

Sets the translation component of this transform to the given translation component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
|----|--------------------|---|

Adds the given x-value to the translation component of this transform.

Parameters

| | | |
|----|----------|--|
| in | <i>x</i> | The x-value of the translation component to add. |
|----|----------|--|

Adds the given y-value to the translation component of this transform.

Parameters

| | | |
|----|----------|--|
| in | <i>y</i> | The y-value of the translation component to add. |
|----|----------|--|

Adds the given z-value to the translation component of this transform.

Parameters

| | | |
|----|----------|--|
| in | <i>z</i> | The z-value of the translation component to add. |
|----|----------|--|

Adds the given translation component to the translation component of this transform.

Parameters

| | | |
|----|----------|--|
| in | <i>x</i> | The x-value of the translation component to add. |
| in | <i>y</i> | The y-value of the translation component to add. |
| in | <i>z</i> | The z-value of the translation component to add. |

Adds the given translation component to the translation component of this transform.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the translation component to add. |
|----|--------------------|--|

Adds the given translation component to the translation component of this transform.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the translation component to add. |
|----|--------------------|--|

Returns the x-value of the translation component of this transform.

Returns

The x-value of the translation component of this transform.

Returns the y-value of the translation component of this transform.

Returns

The y-value of the translation component of this transform.

Returns the z-value of the translation component of this transform.

Returns

The z-value of the translation component of this transform.

Returns the translation component of this transform.

Returns

The translation component of this transform.

Returns the object-to-parent translation matrix of this transform.

Returns

The object-to-parent translation matrix of this transform.

Returns the parent-to-object translation matrix of this transform.

Returns

The parent-to-object translation matrix of this transform.

Sets the x-value of the rotation component of this transform to the given value.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the rotation component. |
|----|---|--|

Sets the y-value of the rotation component of this transform to the given value.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the rotation component. |
|----|---|--|

Sets the z-value of the rotation component of this transform to the given value.

Parameters

| | | |
|----|---|--|
| in | z | The z-value of the rotation component. |
|----|---|--|

Sets the rotation component of this transform to the given rotation component.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the rotation component. |
| in | y | The y-value of the rotation component. |
| in | z | The z-value of the rotation component. |

Sets the rotation component of this transform to the given rotation component.

Parameters

| | | |
|----|----------|--|
| in | rotation | A reference to the rotation component. |
|----|----------|--|

Sets the rotation component of this transform to the given rotation component.

Parameters

| | | |
|----|----------|--|
| in | rotation | A reference to the rotation component. |
|----|----------|--|

Sets the rotation component to a rotation of the given angle around the given normal.

Parameters

| | | |
|----|--------|----------------------------|
| in | normal | A reference to the normal. |
| in | angle | The angle. |

Adds the given x-value to the rotation component of this transform.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the rotation component to add. |
|----|---|---|

Adds the given y-value to the rotation component of this transform.

Parameters

| | | |
|----|---|---|
| in | y | The y-value of the rotation component to add. |
|----|---|---|

Adds the given z-value to the rotation component of this transform.

Parameters

| | | |
|----|---|---|
| in | z | The z-value of the rotation component to add. |
|----|---|---|

Adds the given rotation component to the rotation component of this transform.

Parameters

| | | |
|----|---|---|
| in | x | The x-value of the rotation component to add. |
| in | y | The y-value of the rotation component to add. |
| in | z | The z-value of the rotation component to add. |

Adds the given rotation component to the rotation component of this transform.

Parameters

| | | |
|----|-----------------|---|
| in | <i>rotation</i> | A reference to the rotation component to add. |
|----|-----------------|---|

Adds the given rotation component to the rotation component of this transform.

Parameters

| | | |
|----|-----------------|---|
| in | <i>rotation</i> | A reference to the rotation component to add. |
|----|-----------------|---|

Returns the x-value of the rotation component of this transform.

Returns

The x-value of the rotation component of this transform.

Returns the y-value of the rotation component of this transform.

Returns

The y-value of the rotation component of this transform.

Returns the z-value of the rotation component of this transform.

Returns

The z-value of the rotation component of this transform.

Returns the rotation component of this transform.

Returns

The rotation component of this transform.

Returns the object-to-parent rotation matrix of this transform.

Returns

The object-to-parent rotation matrix of this transform.

Returns the parent-to-object rotation matrix of this transform.

Returns

The parent-to-object rotation matrix of this transform.

Sets the x-value of the scale component of this transform to the given value.

Parameters

| | | |
|----|---|-------------------------------------|
| in | x | The x-value of the scale component. |
|----|---|-------------------------------------|

Sets the y-value of the scale component of this transform to the given value.

Parameters

| | | |
|----|---|-------------------------------------|
| in | y | The y-value of the scale component. |
|----|---|-------------------------------------|

Sets the z-value of the scale component of this transform to the given value.

Parameters

| | | |
|----|---|-------------------------------------|
| in | z | The z-value of the scale component. |
|----|---|-------------------------------------|

Sets the scale component of this transform to the given scale component.

Parameters

| | | |
|----|---|----------------------|
| in | s | The scale component. |
|----|---|----------------------|

Sets the scale component of this transform to the given scale component.

Parameters

| | | |
|----|---|-------------------------------------|
| in | x | The x-value of the scale component. |
| in | y | The y-value of the scale component. |
| in | z | The z-value of the scale component. |

Sets the scale component of this transform to the given scale component.

Parameters

| | | |
|----|-------|-------------------------------------|
| in | scale | A reference to the scale component. |
|----|-------|-------------------------------------|

Sets the scale component of this transform to the given scale component.

Parameters

| | | |
|----|-------|-------------------------------------|
| in | scale | A reference to the scale component. |
|----|-------|-------------------------------------|

Adds the given x-value to the scale component of this transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the scale component to add. |
| in | y | The y-value of the scale component to add. |
| in | z | The z-value of the scale component to add. |

Adds the given y-value to the scale component of this transform.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the scale component to add. |
| in | z | The z-value of the scale component to add. |

Adds the given z-value to the scale component of this transform.

Parameters

| | | |
|----|---|--|
| in | z | The z-value of the scale component to add. |
| in | s | The scale component to add. |

Adds the given scale component to the scale component of this transform.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the scale component to add. |
| in | y | The y-value of the scale component to add. |
| in | z | The z-value of the scale component to add. |

Adds the given scale component to the scale component of this transform.

Parameters

| | | |
|----|--------------|--|
| in | <i>scale</i> | A reference to the scale component to add. |
|----|--------------|--|

Adds the given scale component to the scale component of this transform.

Parameters

| | | |
|----|--------------|--|
| in | <i>scale</i> | A reference to the scale component to add. |
|----|--------------|--|

Returns the x-value of the scale component of this transform.

Returns

The x-value of the scale component of this transform.

Returns the y-value of the scale component of this transform.

Returns

The y-value of the scale component of this transform.

Returns the z-value of the scale component of this transform.

Returns

The z-value of the scale component of this transform.

Returns the scale component of this transform.

Returns

The scale component of this transform.

Returns the object-to-parent scale matrix of this transform.

Returns

The scale object-to-parent matrix of this transform.

Returns the parent-to-object scale matrix of this transform.

Returns

The parent-to-object scale matrix of this transform.

Returns the position of the local origin of this transform expressed in object space coordinates.

Returns

The position of the local origin of this transform expressed in object space coordinates.

Returns the direction of the local x-axis of this transform expressed in object space coordinates.

Returns

The direction of the local x-axis of this transform expressed in object space coordinates.

Returns the direction of the local y-axis of this transform expressed in object space coordinates.

Returns

The direction of the local y-axis of this transform expressed in object space coordinates.

Returns the direction of the local z-axis of this transform expressed in object space coordinates.

Returns

The direction of the local z-axis of this transform expressed in object space coordinates.

Returns the local Cartesian axes system of this transform in object space coordinates.

Returns

The local Cartesian axes system of this transform expressed in object space coordinates.

Returns the local Cartesian coordinate system of this transform in object space coordinates.

Returns

The local Cartesian coordinate system of this transform expressed in object space coordinates.

Returns the position of the local origin of this transform expressed in parent space coordinates.

Returns

The position of the local origin of this transform expressed in parent space coordinates.

Returns the direction of the local x-axis of this transform expressed in parent space coordinates.

Returns

The direction of the local x-axis of this transform expressed in parent space coordinates.

Returns the direction of the local y-axis of this transform expressed in parent space coordinates.

Returns

The direction of the local y-axis of this transform expressed in parent space coordinates.

Returns the direction of the local z-axis of this transform expressed in parent space coordinates.

Returns

The direction of the local z-axis of this transform expressed in parent space coordinates.

Returns the local Cartesian axes system of this transform expressed in parent space coordinates.

Returns

The local Cartesian axes system of this transform expressed in parent space coordinates.

Returns the local Cartesian coordinate system of this transform in parent space coordinates.

Returns

The local Cartesian coordinate system of this transform expressed in parent space coordinates.

Returns the object-to-parent matrix of this transform.

Returns

The object-to-parent matrix of this transform.

Returns the parent-to-object matrix of this transform.

Returns

The parent-to-object matrix of this transform.

Transforms the given vector expressed in object space coordinates to parent space coordinates.

Parameters

| | | |
|----|---------------|--|
| in | <i>vector</i> | A reference to the vector expressed in object space coordinates. |
|----|---------------|--|

Returns

The transformed vector expressed in parent space coordinates.

Transforms the given vector expressed in parent space coordinates to object space coordinates.

Parameters

| | | |
|----|---------------|--|
| in | <i>vector</i> | A reference to the vector expressed in parent space coordinates. |
|----|---------------|--|

Returns

The transformed vector expressed in object space coordinates.

Transforms the given direction expressed in object space coordinates to parent space coordinates.

Parameters

| | | |
|----|------------------|---|
| in | <i>direction</i> | A reference to the direction expressed in object space coordinates. |
|----|------------------|---|

Returns

The transformed (normalized) direction expressed in parent space coordinates.

Sets this transform to dirty.

Updates the object-to-parent matrix of this transform if dirty.

Updates the parent-to-object matrix of this transform if dirty.

The translation component of this transform.

The rotation component (in radians) of this transform.

The scale component of this transform.

The cached object-to-parent matrix of this transform.

The cached parent-to-object matrix of this transform.

A flag indicating whether the object-to-parent matrix of this transform node are dirty.

A flag indicating whether the parent-to-object matrix of this transform node are dirty.

A flag indicating how the back buffers should be rotated to fit the physical rotation of a monitor.

A flag (indicating whether the viewport of this sprite batch has been set.

The viewport of this sprite batch.

4.1.3.2 `_declspec()`

```
mage::_declspec (
    align(16) ) [final]
```

A struct of material buffers used by pixel shaders.

A struct of Cartesian coordinate systems. Constructs a material buffer.

Constructs a material buffer from the given material buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the material buffer to copy. |
|----|---------------|---|

Constructs a material buffer by moving the given material buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the material buffer to move. |
|----|---------------|---|

Destructs this material buffer.

Copies the given material buffer to this material buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the material buffer to copy. |
|----|---------------|---|

Returns

A reference to the copy of the given material buffer (i.e. this material buffer).

Moves the given material buffer to this material buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the material buffer to move. |
|----|---------------|---|

Returns

A reference to the moved material buffer (i.e. this material buffer).

The diffuse reflectivity of this material buffer.

The dissolve factor (i.e. opacity) of this material buffer.

The specular reflectivity of this material buffer.

The specular exponent (surface roughness) of this material buffer.

Constructs a Cartesian coordinate system from the given Cartesian axes system.

Parameters

| | | |
|----|-------------|---|
| in | <i>axes</i> | A reference to the Cartesian axes system. |
|----|-------------|---|

Constructs a Cartesian coordinate system from the given origin and Cartesian axes system.

Parameters

| | | |
|----|-------------|---|
| in | <i>o</i> | A reference to the origin. |
| in | <i>axes</i> | A reference to the Cartesian axes system. |

Constructs a Cartesian coordinate system from the given Cartesian coordinate system.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>coordinate_system</i> | A reference to the Cartesian coordinate system. |
|----|--------------------------|---|

Constructs a Cartesian coordinate system by moving the given Cartesian coordinate system.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>coordinate_system</i> | A reference to the Cartesian coordinate system. |
|----|--------------------------|---|

Destructs this Cartesian coordinate system.

Copies the given Cartesian coordinate system to this Cartesian coordinate system.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>coordinate_system</i> | A reference to the Cartesian coordinate system to copy. |
|----|--------------------------|---|

Returns

A reference to the copy of the given Cartesian coordinate system (i.e. this Cartesian coordinate system).

Moves the given Cartesian coordinate system to this Cartesian coordinate system.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>coordinate_system</i> | A reference to the Cartesian coordinate system to move. |
|----|--------------------------|---|

Returns

A reference to the moved Cartesian coordinate system (i.e. this Cartesian coordinate system).

Returns the origin of this Cartesian coordinate system.

Returns

The origin of this Cartesian coordinate system.

Returns the x-axis of this Cartesian coordinate system.

Returns

The x-axis of this Cartesian coordinate system.

Returns the y-axis of this Cartesian coordinate system.

Returns

The y-axis of this Cartesian coordinate system.

Returns the z-axis of this Cartesian coordinate system.

Returns

The z-axis of this Cartesian coordinate system.

Returns the axes of this Cartesian coordinate system.

Returns

The Cartesian axes system of this Cartesian coordinate system.

The origin of this Cartesian coordinate system.

The Cartesian axes system of this Cartesian coordinate system.

Constructs a Cartesian coordinate system from the given Cartesian axes system.

Parameters

| | | |
|----|-------------|---|
| in | <i>axes</i> | A reference to the Cartesian axes system. |
|----|-------------|---|

Constructs a Cartesian coordinate system from the given origin and Cartesian axes system.

Parameters

| | | |
|----|-------------|---|
| in | <i>o</i> | A reference to the origin. |
| in | <i>axes</i> | A reference to the Cartesian axes system. |

Constructs a Cartesian coordinate system from the given Cartesian coordinate system.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>coordinate_system</i> | A reference to the Cartesian coordinate system. |
|----|--------------------------|---|

Constructs a Cartesian coordinate system by moving the given Cartesian coordinate system.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>coordinate_system</i> | A reference to the Cartesian coordinate system. |
|----|--------------------------|---|

Destructs this Cartesian coordinate system.

Copies the given Cartesian coordinate system to this Cartesian coordinate system.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>coordinate_system</i> | A reference to the Cartesian coordinate system to copy. |
|----|--------------------------|---|

Returns

A reference to the copy of the given Cartesian coordinate system (i.e. this Cartesian coordinate system).

Moves the given Cartesian coordinate system to this Cartesian coordinate system.

Returns

| | | |
|----|--------------------------|---|
| in | <i>coordinate_system</i> | A reference to the Cartesian coordinate system to move. |
|----|--------------------------|---|

Returns

A reference to the moved Cartesian coordinate system (i.e. this Cartesian coordinate system).

Returns the origin of this Cartesian coordinate system.

Returns

The origin of this Cartesian coordinate system.

Returns the x-axis of this Cartesian coordinate system.

Returns

The x-axis of this Cartesian coordinate system.

Returns the y-axis of this Cartesian coordinate system.

Returns

The y-axis of this Cartesian coordinate system.

Returns the z-axis of this Cartesian coordinate system.

Returns

The z-axis of this Cartesian coordinate system.

Returns the axes of this Cartesian coordinate system.

Returns

The Cartesian axes system of this Cartesian coordinate system.

The origin of this Cartesian coordinate system.

The Cartesian axes system of this Cartesian coordinate system.

4.1.3.3 AllocAligned() [1/2]

```
void* mage::AllocAligned (
    size_t size,
    size_t alignment = 16 )
```

Allocates memory on a given alignment boundary of the given size.

Precondition

alignment must be an integer power of 2.

Parameters

| | | |
|----|------------------|--|
| in | <i>size</i> | The requested size in bytes to allocate in memory. |
| in | <i>alignment</i> | The alignment. |

Returns

`nullptr` if the allocation failed.

A pointer to the memory block that was allocated. The pointer is a multiple of the given alignment.

4.1.3.4 AllocAligned() [2/2]

```
template<typename DataT >
DataT* mage::AllocAligned (
    size_t count )
```

Allocates memory on an alignment boundary of 16 bytes.

Template Parameters

| | |
|--------------|--|
| <i>DataT</i> | The type of objects to allocate in memory. |
|--------------|--|

Parameters

| | | |
|----|--------------|---|
| in | <i>count</i> | The number of objects of type <i>DataT</i> to allocate in memory. |
|----|--------------|---|

Returns

`nullptr` if the allocation failed.

A pointer to the memory block that was allocated. The pointer is a multiple of the alignment of 16 bytes.

4.1.3.5 AtomicAdd() [1/2]

```
int32_t mage::AtomicAdd (
    AtomicInt32 * addend,
    int32_t value )
```

Performs an atomic addition operation on the specified values.

Precondition

addend is not equal to `nullptr`.

Parameters

| | | |
|---------|---------------|---|
| in, out | <i>addend</i> | A pointer to the first operand. This value will be replaced with the result of the operation. |
| in | <i>value</i> | The second operand. |

Returns

The function returns the result of the operation.

4.1.3.6 AtomicAdd() [2/2]

```
float mage::AtomicAdd (
    volatile float * addend,
    float value )
```

Performs an atomic addition operation on the specified values.

Precondition

addend is not equal to `nullptr`.

Parameters

| | | |
|---------|---------------|---|
| in, out | <i>addend</i> | A pointer to the first operand. This value will be replaced with the result of the operation. |
| in | <i>value</i> | The second operand. |

Returns

The function returns the result of the operation.

4.1.3.7 AtomicCompareAndSwap()

```
int32_t mage::AtomicCompareAndSwap (
    AtomicInt32 * destination,
    int32_t exchange,
    int32_t comparand )
```

Performs an atomic compare-and-exchange operation on the specified values. The function compares the original value against a given comparand value and exchanges the original value with a given exchange value in case of equality.

Precondition

destination is not equal to `nullptr`.

Parameters

| | | |
|---------|--------------------|--|
| in, out | <i>destination</i> | A pointer to a pointer to the destination value. |
| in | <i>exchange</i> | The exchange value. |
| in | <i>comparand</i> | The value to compare to <i>destination</i> . |

Returns

The function returns the initial value of *destination*.

4.1.3.8 AtomicCompareAndSwapPointer()

```
template<typename T >
T* mage::AtomicCompareAndSwapPointer (
    T ** destination,
    T * exchange,
    T * comparand )
```

Performs an atomic compare-and-exchange operation on the specified pointers. The function compares the original pointer against a given comparand pointer and exchanges the original pointer with a given exchange pointer in case of equality.

Template Parameters

| | |
|------------|------------------|
| <i>The</i> | type of pointer. |
|------------|------------------|

Precondition

destination is not equal to `nullptr`.
exchange is not equal to `nullptr`.

Parameters

| | | |
|----------------|--------------------|--|
| <i>in, out</i> | <i>destination</i> | A pointer to a pointer to the destination value. |
| <i>in</i> | <i>exchange</i> | The exchange pointer. |
| <i>in</i> | <i>comparand</i> | The pointer to compare to <i>destination</i> . |

Returns

The function returns the initial pointer of *destination*.

4.1.3.9 BitsPerPixel()

```
size_t mage::BitsPerPixel (
    DXGI_FORMAT format )
```

Returns the number of bits per pixel of the given format.

Returns

The number of bits per pixel of the given format.

4.1.3.10 BytesBigEndian.ToDouble()

```
double mage::BytesBigEndian.ToDouble (
    const uint8_t * bytes )
```

Reads an double from the given big endian byte array.

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least `sizeof(double)` bytes.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>bytes</i> | A pointer to a big endian byte array. |
|----|--------------|---------------------------------------|

Returns

The `double` represented by the big endian byte array *bytes*.

4.1.3.11 BytesBigEndianToFloat()

```
float mage::BytesBigEndianToFloat (
    const uint8_t * bytes )
```

Reads an float from the given big endian byte array.

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least `sizeof(float)` bytes.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>bytes</i> | A pointer to a big endian byte array. |
|----|--------------|---------------------------------------|

Returns

The `float` represented by the big endian byte array *bytes*.

4.1.3.12 BytesBigEndianToInt16()

```
int16_t mage::BytesBigEndianToInt16 (
    const uint8_t * bytes )
```

Reads an `int16_t` from the given big endian byte array.

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least 2 bytes.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>bytes</i> | A pointer to a big endian byte array. |
|----|--------------|---------------------------------------|

Returns

The `int16_t` represented by the big endian byte array *bytes*.

4.1.3.13 BytesBigEndianToInt32()

```
int32_t mage::BytesBigEndianToInt32 (
    const uint8_t * bytes )
```

Reads an `int32_t` from the given big endian byte array.

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least 4 bytes.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>bytes</i> | A pointer to a big endian byte array. |
|----|--------------|---------------------------------------|

Returns

The `int32_t` represented by the big endian byte array *bytes*.

4.1.3.14 BytesBigEndianToInt64()

```
int64_t mage::BytesBigEndianToInt64 (
    const uint8_t * bytes )
```

Reads an `int64_t` from the given big endian byte array.

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least 8 bytes.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>bytes</i> | A pointer to a big endian byte array. |
|----|--------------|---------------------------------------|

Returns

The `int64_t` represented by the big endian byte array `bytes`.

4.1.3.15 BytesBigEndianToInt8()

```
int8_t mage::BytesBigEndianToInt8 (
    const uint8_t * bytes )
```

Reads an `int8_t` from the given big endian byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least 1 byte.

Parameters

| | | |
|----|--------------------|---------------------------------------|
| in | <code>bytes</code> | A pointer to a big endian byte array. |
|----|--------------------|---------------------------------------|

Returns

The `int8_t` represented by the big endian byte array `bytes`.

4.1.3.16 BytesBigEndianToUInt16()

```
uint16_t mage::BytesBigEndianToUInt16 (
    const uint8_t * bytes )
```

Reads an `uint16_t` from the given big endian byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least 2 bytes.

Parameters

| | | |
|----|--------------------|---------------------------------------|
| in | <code>bytes</code> | A pointer to a big endian byte array. |
|----|--------------------|---------------------------------------|

Returns

The `uint16_t` represented by the big endian byte array `bytes`.

4.1.3.17 BytesBigEndianToUInt32()

```
uint32_t mage::BytesBigEndianToUInt32 (
    const uint8_t * bytes )
```

Reads an `uint32_t` from the given big endian byte array.

Precondition

`bytes` is not equal to `nullptr`.
The given byte array must contain at least 4 bytes.

Parameters

| | | |
|----|--------------------|---------------------------------------|
| in | <code>bytes</code> | A pointer to a big endian byte array. |
|----|--------------------|---------------------------------------|

Returns

The `uint32_t` represented by the big endian byte array `bytes`.

4.1.3.18 BytesBigEndianToInt64()

```
uint64_t mage::BytesBigEndianToInt64 (
    const uint8_t * bytes )
```

Reads an `uint64_t` from the given big endian byte array.

Precondition

`bytes` is not equal to `nullptr`.
The given byte array must contain at least 8 bytes.

Parameters

| | | |
|----|--------------------|---------------------------------------|
| in | <code>bytes</code> | A pointer to a big endian byte array. |
|----|--------------------|---------------------------------------|

Returns

The `uint64_t` represented by the big endian byte array `bytes`.

4.1.3.19 BytesBigEndianToInt8()

```
uint8_t mage::BytesBigEndianToInt8 (
    const uint8_t * bytes )
```

Reads an `uint8_t` from the given big endian byte array.

Precondition

`bytes` is not equal to `nullptr`.
The given byte array must contain at least 1 byte.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>bytes</i> | A pointer to a big endian byte array. |
|----|--------------|---------------------------------------|

Returns

The `uint8_t` represented by the big endian byte array *bytes*.

4.1.3.20 BytesBigEndianToValue()

```
template<typename DataT >
const DataT* mage::BytesBigEndianToValue (
    const uint8_t * bytes )
```

Reads a `DataT` element from the given big endian byte array.

Template Parameters

| | |
|--------------|----------------|
| <i>DataT</i> | The data type. |
|--------------|----------------|

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least `sizeof(DataT)` bytes.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>bytes</i> | A pointer to a big endian byte array. |
|----|--------------|---------------------------------------|

Returns

A pointer to a `DataT` element represented by the big endian byte array *bytes*.

4.1.3.21 BytesLittleEndian.ToDouble()

```
double mage::BytesLittleEndian.ToDouble (
    const uint8_t * bytes )
```

Reads an `double` from the given little endian byte array.

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least `sizeof(double)` bytes.

Parameters

| | | |
|----|--------------|--|
| in | <i>bytes</i> | A pointer to a little endian byte array. |
|----|--------------|--|

Returns

The `double` represented by the little endian byte array *bytes*.

4.1.3.22 BytesLittleEndianToFloat()

```
float mage::BytesLittleEndianToFloat (
    const uint8_t * bytes )
```

Reads an `float` from the given little endian byte array.

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least `sizeof(float)` bytes.

Parameters

| | | |
|----|--------------|--|
| in | <i>bytes</i> | A pointer to a little endian byte array. |
|----|--------------|--|

Returns

The `float` represented by the little endian byte array *bytes*.

4.1.3.23 BytesLittleEndianToInt16()

```
int16_t mage::BytesLittleEndianToInt16 (
    const uint8_t * bytes )
```

Reads an `int16_t` from the given little endian byte array.

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least 2 bytes.

Parameters

| | | |
|----|--------------|--|
| in | <i>bytes</i> | A pointer to a little endian byte array. |
|----|--------------|--|

Returns

The `int16_t` represented by the little endian byte array `bytes`.

4.1.3.24 BytesLittleEndianToInt32()

```
int32_t mage::BytesLittleEndianToInt32 (
    const uint8_t * bytes )
```

Reads an `int32_t` from the given little endian byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least 4 bytes.

Parameters

| | | |
|----|--------------------|--|
| in | <code>bytes</code> | A pointer to a little endian byte array. |
|----|--------------------|--|

Returns

The `int32_t` represented by the little endian byte array `bytes`.

4.1.3.25 BytesLittleEndianToInt64()

```
int64_t mage::BytesLittleEndianToInt64 (
    const uint8_t * bytes )
```

Reads an `int64_t` from the given little endian byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least 8 bytes.

Parameters

| | | |
|----|--------------------|--|
| in | <code>bytes</code> | A pointer to a little endian byte array. |
|----|--------------------|--|

Returns

The `int64_t` represented by the little endian byte array `bytes`.

4.1.3.26 BytesLittleEndianToInt8()

```
int8_t mage::BytesLittleEndianToInt8 (
    const uint8_t * bytes )
```

Reads an `int8_t` from the given little endian byte array.

Precondition

`bytes` is not equal to `nullptr`.
The given byte array must contain at least 1 byte.

Parameters

| | | |
|----|--------------------|--|
| in | <code>bytes</code> | A pointer to a little endian byte array. |
|----|--------------------|--|

Returns

The `int8_t` represented by the little endian byte array `bytes`.

4.1.3.27 BytesLittleEndianToInt16()

```
uint16_t mage::BytesLittleEndianToInt16 (
    const uint8_t * bytes )
```

Reads an `uint16_t` from the given little endian byte array.

Precondition

`bytes` is not equal to `nullptr`.
The given byte array must contain at least 2 bytes.

Parameters

| | | |
|----|--------------------|--|
| in | <code>bytes</code> | A pointer to a little endian byte array. |
|----|--------------------|--|

Returns

The `uint16_t` represented by the little endian byte array `bytes`.

4.1.3.28 BytesLittleEndianToInt32()

```
uint32_t mage::BytesLittleEndianToInt32 (
    const uint8_t * bytes )
```

Reads an `uint32_t` from the given little endian byte array.

Precondition

`bytes` is not equal to `nullptr`.
The given byte array must contain at least 4 bytes.

Parameters

| | | |
|----|--------------|--|
| in | <i>bytes</i> | A pointer to a little endian byte array. |
|----|--------------|--|

Returns

The `uint32_t` represented by the little endian byte array *bytes*.

4.1.3.29 BytesLittleEndianToUInt64()

```
uint64_t mage::BytesLittleEndianToUInt64 (
    const uint8_t * bytes )
```

Reads an `uint64_t` from the given little endian byte array.

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least 8 bytes.

Parameters

| | | |
|----|--------------|--|
| in | <i>bytes</i> | A pointer to a little endian byte array. |
|----|--------------|--|

Returns

The `uint64_t` represented by the little endian byte array *bytes*.

4.1.3.30 BytesLittleEndianToInt8()

```
uint8_t mage::BytesLittleEndianToInt8 (
    const uint8_t * bytes )
```

Reads an `uint8_t` from the given little endian byte array.

Precondition

bytes is not equal to `nullptr`.

The given byte array must contain at least 1 byte.

Parameters

| | | |
|----|--------------|--|
| in | <i>bytes</i> | A pointer to a little endian byte array. |
|----|--------------|--|

Returns

The `uint8_t` represented by the little endian byte array `bytes`.

4.1.3.31 BytesToDouble()

```
double mage::BytesToDouble (
    const uint8_t * bytes,
    bool big_endian )
```

Reads an double from the given byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least `sizeof(double)` bytes.

Parameters

| | | |
|----|-------------------------|---|
| in | <code>bytes</code> | A pointer to a byte array. |
| in | <code>big_endian</code> | Flag indicating whether the given byte array should be interpreted as big endian or not (i.e. little endian). |

Returns

The `double` represented by the byte array `bytes`.

4.1.3.32 BytesToFloat()

```
float mage::BytesToFloat (
    const uint8_t * bytes,
    bool big_endian )
```

Reads an float from the given byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least `sizeof(float)` bytes.

Parameters

| | | |
|----|-------------------------|---|
| in | <code>bytes</code> | A pointer to a byte array. |
| in | <code>big_endian</code> | Flag indicating whether the given byte array should be interpreted as big endian or not (i.e. little endian). |

Returns

The `float` represented by the byte array `bytes`.

4.1.3.33 BytesToInt16()

```
int16_t mage::BytesToInt16 (
    const uint8_t * bytes,
    bool big_endian )
```

Reads an `int16_t` from the given byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least 2 bytes.

Parameters

| | | |
|----|-------------------------|---|
| in | <code>bytes</code> | A pointer to a byte array. |
| in | <code>big_endian</code> | Flag indicating whether the given byte array should be interpreted as big endian or not (i.e. little endian). |

Returns

The `int16_t` represented by the byte array `bytes`.

4.1.3.34 BytesToInt32()

```
int32_t mage::BytesToInt32 (
    const uint8_t * bytes,
    bool big_endian )
```

Reads an `int32_t` from the given byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least 4 bytes.

Parameters

| | | |
|----|-------------------------|---|
| in | <code>bytes</code> | A pointer to a byte array. |
| in | <code>big_endian</code> | Flag indicating whether the given byte array should be interpreted as big endian or not (i.e. little endian). |

Returns

The `int32_t` represented by the byte array `bytes`.

4.1.3.35 BytesToInt64()

```
int64_t mage::BytesToInt64 (
    const uint8_t * bytes,
    bool big_endian )
```

Reads an `int64_t` from the given byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least 8 bytes.

Parameters

| | | |
|----|-------------------------|---|
| in | <code>bytes</code> | A pointer to a byte array. |
| in | <code>big_endian</code> | Flag indicating whether the given byte array should be interpreted as big endian or not (i.e. little endian). |

Returns

The `int64_t` represented by the byte array `bytes`.

4.1.3.36 BytesToInt8()

```
int8_t mage::BytesToInt8 (
    const uint8_t * bytes )
```

Reads an `int8_t` from the given byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least 1 byte.

Parameters

| | | |
|----|--------------------|----------------------------|
| in | <code>bytes</code> | A pointer to a byte array. |
|----|--------------------|----------------------------|

Returns

The `int8_t` represented by the byte array `bytes`.

4.1.3.37 BytesToInt16()

```
uint16_t mage::BytesToInt16 (
    const uint8_t * bytes,
    bool big_endian )
```

Reads an `uint16_t` from the given byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least 2 bytes.

Parameters

| | | |
|----|-------------------------|---|
| in | <code>bytes</code> | A pointer to a byte array. |
| in | <code>big_endian</code> | Flag indicating whether the given byte array should be interpreted as big endian or not (i.e. little endian). |

Returns

The `uint16_t` represented by the byte array `bytes`.

4.1.3.38 BytesToInt32()

```
uint32_t mage::BytesToInt32 (
    const uint8_t * bytes,
    bool big_endian )
```

Reads an `uint32_t` from the given byte array.

Precondition

`bytes` is not equal to `nullptr`.

The given byte array must contain at least 4 bytes.

Parameters

| | | |
|----|-------------------------|---|
| in | <code>bytes</code> | A pointer to a byte array. |
| in | <code>big_endian</code> | Flag indicating whether the given byte array should be interpreted as big endian or not (i.e. little endian). |

Returns

The `uint32_t` represented by the byte array `bytes`.

4.1.3.39 BytesToInt64()

```
uint64_t mage::BytesToInt64 (
```

```
const uint8_t * bytes,
bool big_endian )
```

Reads an `uint64_t` from the given byte array.

Precondition

`bytes` is not equal to `nullptr`.
The given byte array must contain at least 8 bytes.

Parameters

| | | |
|----|-------------------------|---|
| in | <code>bytes</code> | A pointer to a byte array. |
| in | <code>big_endian</code> | Flag indicating whether the given byte array should be interpreted as big endian or not (i.e. little endian). |

Returns

The `uint64_t` represented by the byte array `bytes`.

4.1.3.40 BytesToInt8()

```
uint8_t mage::BytesToInt8 (
    const uint8_t * bytes )
```

Reads an `uint8_t` from the given byte array.

Precondition

`bytes` is not equal to `nullptr`.
The given byte array must contain at least 1 byte.

Parameters

| | | |
|----|--------------------|----------------------------|
| in | <code>bytes</code> | A pointer to a byte array. |
|----|--------------------|----------------------------|

Returns

The `uint8_t` represented by the byte array `bytes`.

4.1.3.41 Clamp()

```
template<typename ValueT >
ValueT mage::Clamp (
    ValueT value,
    ValueT low = 0,
    ValueT high = 1 )
```

Clamps the given value between the given low and hight value.

Precondition

low is not greater than *high*.

Template Parameters

| | |
|---------------|--------------------|
| <i>ValueT</i> | The type of value. |
|---------------|--------------------|

Parameters

| | | |
|----|--------------|--------------------|
| in | <i>value</i> | The value. |
| in | <i>low</i> | The minimum value. |
| in | <i>high</i> | The maximum value. |

Returns

The clamped value between the given minimum and maximum value.

4.1.3.42 ClampAngleDegrees() [1/2]

```
float mage::ClampAngleDegrees (
    float angle )
```

Clamps the given angle (in degrees) to (-180, 180].

Parameters

| | | |
|----|--------------|-------------------------|
| in | <i>angle</i> | The angle (in degrees). |
|----|--------------|-------------------------|

Returns

The clamped angle (in degrees).

4.1.3.43 ClampAngleDegrees() [2/2]

```
float mage::ClampAngleDegrees (
    float angle,
    float min_angle,
    float max_angle )
```

Clamps the given angle (in degrees) between the given minimum and maximum angle (in degrees).

Precondition

min_angle lies in [-180, 180].

max_angle lies in [-180, 180].

min_angle is not greater than *max_angle*.

Parameters

| | | |
|----|------------------|---------------------------------|
| in | <i>angle</i> | The angle (in degrees). |
| in | <i>min_angle</i> | The minimum angle (in degrees). |
| in | <i>max_angle</i> | The maximum angle (in degrees). |

Returns

The clamped angle between the given minimum and maximum angle (in degrees).

4.1.3.44 ClampAngleRadians() [1/2]

```
float mage::ClampAngleRadians (
    float angle )
```

Clamps the given angle (in radians) to [-pi, pi].

Parameters

| | | |
|----|--------------|-------------------------|
| in | <i>angle</i> | The angle (in radians). |
|----|--------------|-------------------------|

Returns

The clamped angle (in radians).

4.1.3.45 ClampAngleRadians() [2/2]

```
float mage::ClampAngleRadians (
    float angle,
    float min_angle,
    float max_angle )
```

Clamps the given angle (in radians) between the given minimum and maximum angle (in radians).

Precondition

- min_angle* lies in [-pi, pi].
- max_angle* lies in [-pi, pi].
- min_angle* is not greater than *max_angle*.

Parameters

| | | |
|----|------------------|---------------------------------|
| in | <i>angle</i> | The angle (in radians). |
| in | <i>min_angle</i> | The minimum angle (in radians). |
| in | <i>max_angle</i> | The maximum angle (in radians). |

Returns

The clamped angle between the given minimum and maximum angle (in radians).

4.1.3.46 ComboBoxAdd()

```
void mage::ComboBoxAdd (
    HWND dialog,
    int id,
    const void * data,
    const wchar_t * desc )
```

Adds an item associated with the given data and described with the given descriptor to a combo box.

Precondition

dialog is not equal to `nullptr`.
desc is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|---|
| in | <i>dialog</i> | A handle to the dialog box that contains the control. |
| in | <i>id</i> | The identifier of the control to be retrieved. |
| in | <i>data</i> | A pointer to the data of the item to add. |
| in | <i>desc</i> | The description of the item to add. |

4.1.3.47 ComboBoxAddData()

```
template<typename DataT >
void mage::ComboBoxAddData (
    HWND dialog,
    int id,
    const DataT data,
    const wchar_t * desc )
```

Adds an item associated with the given data and described with the given descriptor to a combo box.

Precondition

dialog is not equal to `nullptr`.
desc is not equal to `nullptr`.

Template Parameters

| | |
|------------|------------|
| <i>The</i> | data type. |
|------------|------------|

Parameters

| | | |
|----|---------------|---|
| in | <i>dialog</i> | A handle to the dialog box that contains the control. |
|----|---------------|---|

Parameters

| | | |
|----|-------------|--|
| in | <i>id</i> | The identifier of the control to be retrieved. |
| in | <i>data</i> | The data of the item to add. |
| in | <i>desc</i> | The description of the item to add. |

Note

This function casts *data* to `void*`.

4.1.3.48 ComboBoxContains()

```
bool mage::ComboBoxContains (
    HWND dialog,
    int id,
    const wchar_t * desc )
```

Checks whether a combo box contains the given descriptor.

Precondition

dialog is not equal to `nullptr`.
desc is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|---|
| in | <i>dialog</i> | A handle to the dialog box that contains the control. |
| in | <i>id</i> | The identifier of the control to be retrieved. |
| in | <i>desc</i> | The string description to check. |

Returns

`true` if the given description is contained in the combo box. `false` otherwise.

4.1.3.49 ComboBoxCount()

```
int mage::ComboBoxCount (
    HWND dialog,
    int id )
```

Returns the number of items in a combo box.

Precondition

dialog is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|---|
| in | <i>dialog</i> | A handle to the dialog box that contains the control. |
| in | <i>id</i> | The identifier of the control to be retrieved. |

Returns

The number of items of a combo box.

4.1.3.50 ComboBoxSelect() [1/2]

```
void mage::ComboBoxSelect (
    HWND dialog,
    int id,
    int index )
```

Selects the item at the given index in a combo box.

Precondition

dialog is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|---|
| in | <i>dialog</i> | A handle to the dialog box that contains the control. |
| in | <i>id</i> | The identifier of the control to be retrieved. |
| in | <i>index</i> | The index of the item. |

4.1.3.51 ComboBoxSelect() [2/2]

```
void mage::ComboBoxSelect (
    HWND dialog,
    int id,
    const void * data )
```

Selects the item associated with the given data in a combo box.

Precondition

dialog is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|---|
| in | <i>dialog</i> | A handle to the dialog box that contains the control. |
| in | <i>id</i> | The identifier of the control to be retrieved. |
| in | <i>data</i> | A pointer to the data of the item. |

4.1.3.52 ComboBoxSelectData()

```
template<typename DataT >
void mage::ComboBoxSelectData (
    HWND dialog,
    int id,
    const DataT data )
```

Selects the item associated with the given data in a combo box.

Precondition

dialog is not equal to `nullptr`.

Template Parameters

| | |
|------------|------------|
| <i>The</i> | data type. |
|------------|------------|

Parameters

| | | |
|----|---------------|---|
| in | <i>dialog</i> | A handle to the dialog box that contains the control. |
| in | <i>id</i> | The identifier of the control to be retrieved. |
| in | <i>data</i> | The data of the item to add. |

Note

This function casts *data* to `void*`.

4.1.3.53 ComboBoxSelected()

```
const void * mage::ComboBoxSelected (
    HWND dialog,
    int id )
```

Returns the data associated with the selected item in a combo box.

Precondition

dialog is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|---|
| in | <i>dialog</i> | A handle to the dialog box that contains the control. |
| in | <i>id</i> | The identifier of the control to be retrieved. |

Returns

`nullptr` if the combo box has no items.

A pointer to the data associated with the selected item in the combo box.

4.1.3.54 ComboBoxSelectedData()

```
template<typename DataT >
const DataT mage::ComboBoxSelectedData (
    HWND dialog,
    int id )
```

Returns the data associated with the selected item in a combo box.

Precondition

dialog is not equal to `nullptr`.
The combo box must have at least one item.

Template Parameters

| | |
|------------|------------|
| <i>The</i> | data type. |
|------------|------------|

Parameters

| | | |
|----|---------------|---|
| in | <i>dialog</i> | A handle to the dialog box that contains the control. |
| in | <i>id</i> | The identifier of the control to be retrieved. |

Returns

The data associated with the selected item in the combo box.

Note

This function converts the `void*` data to `DataT` data.

4.1.3.55 ComboBoxSomethingSelected()

```
bool mage::ComboBoxSomethingSelected (
    HWND dialog,
    int id )
```

Checks whether a valid item is selected in a combo box.

Precondition

dialog is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|---|
| in | <i>dialog</i> | A handle to the dialog box that contains the control. |
| in | <i>id</i> | The identifier of the control to be retrieved. |

Returns

`true` if a valid item is selected in the combo box. `false` otherwise.

4.1.3.56 CompileShaderFromFile()

```
HRESULT mage::CompileShaderFromFile (
    const wstring & fname,
    const string & entry_point,
    const string & shader_target,
    ID3DBlob ** output_blob )
```

Compiles Microsoft High Level Shader Language (HLSL) code into bytecode for a given shader target.

Parameters

| | | |
|-----|----------------------|---|
| in | <i>fname</i> | A pointer to a constant null-terminated string that contains the name of the file that contains the shader code. |
| in | <i>entry_point</i> | A pointer to a constant null-terminated string that contains the name of the shader entry point function where shader execution begins. |
| in | <i>shader_target</i> | A pointer to a constant null-terminated string that specifies the shader target or set of shader features to compile against. |
| out | <i>output_blob</i> | A pointer to a variable that receives a pointer to the ID3DBlob interface that you can use to access the compiled code. |

4.1.3.57 ConsoleWidth()

```
uint16_t mage::ConsoleWidth ( )
```

Returns the fixed console width.

Returns

The fixed console width.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to retrieve a handle to the standard output device. |
|---------------------------|--|

4.1.3.58 const_pointer_cast()

```
template<typename T , typename U >
UniquePtr< T > mage::const_pointer_cast (
    UniquePtr< U > && ptr )
```

Creates a unique pointer whose stored pointer is obtained by const casting the stored pointer of the given unique pointer.

Template Parameters

| | |
|----------|---------------------------|
| <i>T</i> | The conversion to-type. |
| <i>U</i> | The conversion from-type. |

Parameters

| | | |
|----|------------|-----------------------------|
| in | <i>ptr</i> | The unique pointer to move. |
|----|------------|-----------------------------|

Returns

The moved unique pointer.

4.1.3.59 ConvertAbsoluteToNormalizedScreen() [1/3]

```
const XMVECTOR mage::ConvertAbsoluteToNormalizedScreen (
    const XMVECTOR & position )
```

Converts the given absolute screen position to normalized screen position.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|-----------------|-------------------------------------|
| in | <i>position</i> | The given absolute screen position. |
|----|-----------------|-------------------------------------|

4.1.3.60 ConvertAbsoluteToNormalizedScreen() [2/3]

```
const XMFLOAT2 mage::ConvertAbsoluteToNormalizedScreen (
    float x,
    float y )
```

Converts the given absolute screen values to normalized screen values.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|----------|------------------------------------|
| in | <i>x</i> | The given absolute screen x-value. |
| in | <i>y</i> | The given absolute screen y-value. |

4.1.3.61 ConvertAbsoluteToNormalizedScreen() [3/3]

```
const XMFLOAT2 mage::ConvertAbsoluteToNormalizedScreen (
    const XMFLOAT2 & position )
```

Converts the given absolute screen position to normalized screen position.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|----------|-------------------------------------|
| in | position | The given absolute screen position. |
|----|----------|-------------------------------------|

4.1.3.62 ConvertAbsoluteToNormalizedScreenX()

```
float mage::ConvertAbsoluteToNormalizedScreenX (
    float x )
```

Converts the given absolute screen x-value to normalized screen x-value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|------------------------------------|
| in | x | The given absolute screen x-value. |
|----|---|------------------------------------|

4.1.3.63 ConvertAbsoluteToNormalizedScreenY()

```
float mage::ConvertAbsoluteToNormalizedScreenY (
    float y )
```

Converts the given absolute screen y-value to normalized screen y-value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|------------------------------------|
| in | y | The given absolute screen y-value. |
|----|---|------------------------------------|

4.1.3.64 ConvertNormalizedToAbsoluteScreen() [1/3]

```
const XMVECTOR mage::ConvertNormalizedToAbsoluteScreen (
    const XMVECTOR & position )
```

Converts the given normalized screen position to absolute screen position.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|-----------------|---------------------------------------|
| in | <i>position</i> | The given normalized screen position. |
|----|-----------------|---------------------------------------|

4.1.3.65 ConvertNormalizedToAbsoluteScreen() [2/3]

```
const XMFLOAT2 mage::ConvertNormalizedToAbsoluteScreen (
    float x,
    float y )
```

Converts the given normalized screen values to absolute screen values.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|----------|--------------------------------------|
| in | <i>x</i> | The given normalized screen x-value. |
| in | <i>y</i> | The given normalized screen y-value. |

4.1.3.66 ConvertNormalizedToAbsoluteScreen() [3/3]

```
const XMFLOAT2 mage::ConvertNormalizedToAbsoluteScreen (
    const XMFLOAT2 & position )
```

Converts the given normalized screen position to absolute screen position.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|-----------------|---------------------------------------|
| in | <i>position</i> | The given normalized screen position. |
|----|-----------------|---------------------------------------|

4.1.3.67 ConvertNormalizedToAbsoluteScreenX()

```
float mage::ConvertNormalizedToAbsoluteScreenX (
    float x )
```

Converts the given normalized screen x-value to absolute screen x-value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--------------------------------------|
| in | x | The given normalized screen x-value. |
|----|---|--------------------------------------|

4.1.3.68 ConvertNormalizedToAbsoluteScreenY()

```
float mage::ConvertNormalizedToAbsoluteScreenY (
    float y )
```

Converts the given normalized screen y-value to absolute screen y-value.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|---|--------------------------------------|
| in | y | The given normalized screen y-value. |
|----|---|--------------------------------------|

4.1.3.69 ConvertRefreshRate()

```
size_t mage::ConvertRefreshRate (
    const DXGI_MODE_DESC1 & desc )
```

Converts the refresh rate of the given display format descriptor to a size_t.

Parameters

| | | |
|----|------|---|
| in | desc | A reference to the display format descriptor. |
|----|------|---|

Returns

A size_t value corresponding to the refresh rate of the given display format descriptor.

4.1.3.70 ConvertResolution()

```
size_t mage::ConvertResolution (
    const DXGI_MODE_DESC1 & desc )
```

Converts the resolution of the given display format descriptor to a `size_t`.

Parameters

| | | |
|----|-------------|---|
| in | <i>desc</i> | A reference to the display format descriptor. |
|----|-------------|---|

Returns

A `size_t` value corresponding to the resolution of the given display format descriptor.

4.1.3.71 ConvertTimestamp()

```
uint64_t mage::ConvertTimestamp (
    const FILETIME & ftime )
```

Converts the given file time to a `uint64_t` (in 100 ns).

Parameters

| | | |
|----|--------------|-------------------------------|
| in | <i>ftime</i> | A reference to the file time. |
|----|--------------|-------------------------------|

Returns

A `uint64_t` (in 100 ns) representing the given file time *ftime*.

4.1.3.72 ConvertToSRGB()

```
DXGI_FORMAT mage::ConvertToSRGB (
    DXGI_FORMAT format )
```

Converts the given format to an SRGB format.

Returns

The converted format.

4.1.3.73 CreateAdditiveBlendState()

```
HRESULT mage::CreateAdditiveBlendState (
    ID3D11Device2 * device,
    ID3D11BlendState ** blend_state )
```

4.1.3.74 CreateAlphaBlendState()

```
HRESULT mage::CreateAlphaBlendState (
    ID3D11Device2 * device,
    ID3D11BlendState ** blend_state )
```

4.1.3.75 CreateAnisotropicClampSamplerState()

```
HRESULT mage::CreateAnisotropicClampSamplerState (
    ID3D11Device2 * device,
    ID3D11SamplerState ** sampler_state )
```

4.1.3.76 CreateAnisotropicWrapSamplerState()

```
HRESULT mage::CreateAnisotropicWrapSamplerState (
    ID3D11Device2 * device,
    ID3D11SamplerState ** sampler_state )
```

4.1.3.77 CreateBlackTexture()

`SharedPtr< Texture > mage::CreateBlackTexture ()`

Creates a black texture.

Precondition

The current engine must be loaded.
The standard assets must be present.

Returns

A pointer to the texture.

Exceptions

| | |
|---------------------------------|-------------------------------|
| <code>FormattedException</code> | Failed to create the texture. |
|---------------------------------|-------------------------------|

4.1.3.78 CreateBlendState()

```
HRESULT mage::CreateBlendState (
    ID3D11Device2 * device,
    ID3D11BlendState ** blend_state,
    D3D11_BLEND src_blend,
    D3D11_BLEND dest_blend )
```

4.1.3.79 CreateBlinnPhongShader()

```
const CombinedShader mage::CreateBlinnPhongShader ( )
```

Creates a Blinn-Phong shader.

Precondition

The current engine must be loaded.

Returns

The Blinn-Phong shader.

Exceptions

| | |
|------------------------------------|---|
| FormattedException | Failed to create the lambertian shader. |
|------------------------------------|---|

4.1.3.80 CreateCompiledBlinnPhongPixelShader()

```
const CompiledPixelShader mage::CreateCompiledBlinnPhongPixelShader ( )
```

Returns the compiled Blinn-Phong pixel shader.

Returns

The compiled Blinn-Phong pixel shader.

4.1.3.81 CreateCompiledDiffusePixelShader()

```
const CompiledPixelShader mage::CreateCompiledDiffusePixelShader ( )
```

Returns the compiled diffuse pixel shader.

Returns

The compiled diffuse pixel shader.

4.1.3.82 CreateCompiledLambertianPixelShader()

```
const CompiledPixelShader mage::CreateCompiledLambertianPixelShader ( )
```

Returns the compiled Lambertian pixel shader.

Returns

The compiled Lambertian pixel shader.

4.1.3.83 CreateCompiledModifiedBlinnPhongPixelShader()

```
const CompiledPixelShader mage::CreateCompiledModifiedBlinnPhongPixelShader ( )
```

Returns the compiled Modified Blinn-Phong pixel shader.

Returns

The compiled Modified Blinn-Phong pixel shader.

4.1.3.84 CreateCompiledPhongPixelShader()

```
const CompiledPixelShader mage::CreateCompiledPhongPixelShader ( )
```

Returns the compiled Phong pixel shader.

Returns

The compiled Phong pixel shader.

4.1.3.85 CreateCompiledSpritePixelShader()

```
const CompiledPixelShader mage::CreateCompiledSpritePixelShader ( )
```

Returns the compiled sprite pixel shader.

Returns

The compiled sprite pixel shader.

4.1.3.86 CreateCompiledSpriteVertexShader()

```
const CompiledVertexShader mage::CreateCompiledSpriteVertexShader ( )
```

Returns the compiled sprite vertex shader.

Returns

The compiled sprite vertex shader.

4.1.3.87 CreateCompiledTransformVertexShader()

```
const CompiledVertexShader mage::CreateCompiledTransformVertexShader ( )
```

Returns the compiled transform vertex shader.

Returns

The compiled transform vertex shader.

4.1.3.88 CreateConstantBuffer()

```
template<typename DataT >
HRESULT mage::CreateConstantBuffer (
    ID3D11Device2 * device,
    ID3D11Buffer ** buffer,
    size_t count = 1 )
```

4.1.3.89 CreateCullClockwiseRasterizerState()

```
HRESULT mage::CreateCullClockwiseRasterizerState (
    ID3D11Device2 * device,
    ID3D11RasterizerState ** rasterizer_state )
```

4.1.3.90 CreateCullCounterClockwiseRasterizerState()

```
HRESULT mage::CreateCullCounterClockwiseRasterizerState (
    ID3D11Device2 * device,
    ID3D11RasterizerState ** rasterizer_state )
```

4.1.3.91 CreateCullNoneRasterizerState()

```
HRESULT mage::CreateCullNoneRasterizerState (
    ID3D11Device2 * device,
    ID3D11RasterizerState ** rasterizer_state )
```

4.1.3.92 CreateD3DResources()

```
static HRESULT mage::CreateD3DResources (
    _In_ ID3D11Device2 * device,
    _In_ uint32_t res_dim,
    _In_ size_t width,
    _In_ size_t height,
    _In_ size_t depth,
    _In_ size_t mip_count,
    _In_ size_t array_size,
    _In_ DXGI_FORMAT format,
    _In_ D3D11_USAGE usage,
    _In_ uint32_t bindFlags,
    _In_ uint32_t cpu_access_flags,
    _In_ uint32_t misc_flags,
    _In_ bool forceSRGB,
    _In_ bool is_cube_map,
    _In_reads_opt_(mip_count *array_size) D3D11_SUBRESOURCE_DATA * init_data,
    _Outptr_opt_ ID3D11Resource ** texture,
    _Outptr_opt_ ID3D11ShaderResourceView ** texture_view ) [static]
```

4.1.3.93 CreateDDSTextureFromFile() [1/4]

```
HRESULT mage::CreateDDSTextureFromFile (
    _In_ ID3D11Device2 * device,
    _In_z_ const wchar_t * szFileName,
    _Outptr_opt_ ID3D11Resource ** texture,
    _Outptr_opt_ ID3D11ShaderResourceView ** texture_view,
    _In_ size_t maxsize = 0,
    _Out_opt_ DDS_ALPHA_MODE * alpha_mode = nullptr )
```

4.1.3.94 CreateDDSTextureFromFile() [2/4]

```
HRESULT mage::CreateDDSTextureFromFile (
    _In_ ID3D11Device2 * device,
    _In_opt_ ID3D11DeviceContext * device_context,
    _In_z_ const wchar_t * szFileName,
    _Outptr_opt_ ID3D11Resource ** texture,
    _Outptr_opt_ ID3D11ShaderResourceView ** texture_view,
    _In_ size_t maxsize = 0,
    _Out_opt_ DDS_ALPHA_MODE * alpha_mode = nullptr )
```

4.1.3.95 CreateDDSTextureFromFile() [3/4]

```
_Use_decl_annotations_ HRESULT mage::CreateDDSTextureFromFile (
    ID3D11Device2 * device,
    const wchar_t * file_name,
    ID3D11Resource ** texture,
    ID3D11ShaderResourceView ** texture_view,
    size_t maxsize,
    DDS_ALPHA_MODE * alpha_mode )
```

4.1.3.96 CreateDDSTextureFromFile() [4/4]

```
_Use_decl_annotations_ HRESULT mage::CreateDDSTextureFromFile (
    ID3D11Device2 * device,
    ID3D11DeviceContext * device_context,
    const wchar_t * file_name,
    ID3D11Resource ** texture,
    ID3D11ShaderResourceView ** texture_view,
    size_t maxsize,
    DDS_ALPHA_MODE * alpha_mode )
```

4.1.3.97 CreateDDSTextureFromFileEx() [1/4]

```
HRESULT mage::CreateDDSTextureFromFileEx (
    _In_ ID3D11Device2 * device,
    _In_z_ const wchar_t * szFileName,
    _In_ size_t maxsize,
    _In_ D3D11_USAGE usage,
    _In_ uint32_t bindFlags,
    _In_ uint32_t cpu_access_flags,
    _In_ uint32_t misc_flags,
    _In_ bool forceSRGB,
    _Outptr_opt_ ID3D11Resource ** texture,
    _Outptr_opt_ ID3D11ShaderResourceView ** texture_view,
    _Out_opt_ DDS_ALPHA_MODE * alpha_mode = nullptr )
```

4.1.3.98 CreateDDSTextureFromFileEx() [2/4]

```
HRESULT mage::CreateDDSTextureFromFileEx (
    _In_ ID3D11Device2 * device,
    _In_opt_ ID3D11DeviceContext * device_context,
    _In_z_ const wchar_t * szFileName,
    _In_ size_t maxsize,
    _In_ D3D11_USAGE usage,
    _In_ uint32_t bindFlags,
    _In_ uint32_t cpu_access_flags,
    _In_ uint32_t misc_flags,
    _In_ bool forceSRGB,
    _Outptr_opt_ ID3D11Resource ** texture,
    _Outptr_opt_ ID3D11ShaderResourceView ** texture_view,
    _Out_opt_ DDS_ALPHA_MODE * alpha_mode = nullptr )
```

4.1.3.99 CreateDDSTextureFromFileEx() [3/4]

```
_Use_decl_annotations_ HRESULT mage::CreateDDSTextureFromFileEx (
    ID3D11Device2 * device,
    const wchar_t * file_name,
    size_t maxsize,
    D3D11_USAGE usage,
    uint32_t bindFlags,
    uint32_t cpu_access_flags,
    uint32_t misc_flags,
    bool forceSRGB,
    ID3D11Resource ** texture,
    ID3D11ShaderResourceView ** texture_view,
    DDS_ALPHA_MODE * alpha_mode )
```

4.1.3.100 CreateDDSTextureFromFileEx() [4/4]

```
_Use_decl_annotations_ HRESULT mage::CreateDDSTextureFromFileEx (
    ID3D11Device2 * device,
    ID3D11DeviceContext * device_context,
    const wchar_t * file_name,
    size_t maxsize,
    D3D11_USAGE usage,
    uint32_t bindFlags,
    uint32_t cpu_access_flags,
    uint32_t misc_flags,
    bool forceSRGB,
    ID3D11Resource ** texture,
    ID3D11ShaderResourceView ** texture_view,
    DDS_ALPHA_MODE * alpha_mode )
```

4.1.3.101 CreateDDSTextureFromMemory() [1/4]

```
HRESULT mage::CreateDDSTextureFromMemory (
    _In_ ID3D11Device2 * device,
    _In_reads_bytes_(dds_dataSize) const uint8_t * dds_data,
    _In_ size_t dds_dataSize,
    _Outptr_opt_ ID3D11Resource ** texture,
    _Outptr_opt_ ID3D11ShaderResourceView ** texture_view,
    _In_ size_t maxsize = 0,
    _Out_opt_ DDS_ALPHA_MODE * alpha_mode = nullptr )
```

4.1.3.102 CreateDDSTextureFromMemory() [2/4]

```
HRESULT mage::CreateDDSTextureFromMemory (
    _In_ ID3D11Device2 * device,
    _In_opt_ ID3D11DeviceContext * device_context,
    _In_reads_bytes_(dds_dataSize) const uint8_t * dds_data,
    _In_ size_t dds_dataSize,
    _Outptr_opt_ ID3D11Resource ** texture,
    _Outptr_opt_ ID3D11ShaderResourceView ** texture_view,
    _In_ size_t maxsize = 0,
    _Out_opt_ DDS_ALPHA_MODE * alpha_mode = nullptr )
```

4.1.3.103 CreateDDSTextureFromMemory() [3/4]

```
_Use_decl_annotations_ HRESULT mage::CreateDDSTextureFromMemory (
    ID3D11Device2 * device,
    const uint8_t * dds_data,
    size_t dds_dataSize,
    ID3D11Resource ** texture,
    ID3D11ShaderResourceView ** texture_view,
    size_t maxsize,
    DDS_ALPHA_MODE * alpha_mode )
```

4.1.3.104 CreateDDSTextureFromMemory() [4/4]

```
_Use_decl_annotations_ HRESULT mage::CreateDDSTextureFromMemory (
    ID3D11Device2 * device,
    ID3D11DeviceContext * device_context,
    const uint8_t * dds_data,
    size_t dds_dataSize,
    ID3D11Resource ** texture,
    ID3D11ShaderResourceView ** texture_view,
    size_t maxsize,
    DDS_ALPHA_MODE * alpha_mode )
```

4.1.3.105 CreateDDSTextureFromMemoryEx() [1/4]

```
HRESULT mage::CreateDDSTextureFromMemoryEx (
    _In_ ID3D11Device2 * device,
    _In_reads_bytes_(dds_dataSize) const uint8_t * dds_data,
    _In_ size_t dds_dataSize,
    _In_ size_t maxsize,
    _In_ D3D11_USAGE usage,
    _In_ uint32_t bindFlags,
    _In_ uint32_t cpu_access_flags,
    _In_ uint32_t misc_flags,
    _In_ bool forceSRGB,
    _Outptr_opt_ ID3D11Resource ** texture,
    _Outptr_opt_ ID3D11ShaderResourceView ** texture_view,
    _Out_opt_ DDS_ALPHA_MODE * alpha_mode = nullptr )
```

4.1.3.106 CreateDDSTextureFromMemoryEx() [2/4]

```
HRESULT mage::CreateDDSTextureFromMemoryEx (
    _In_ ID3D11Device2 * device,
    _In_opt_ ID3D11DeviceContext * device_context,
    _In_reads_bytes_(dds_dataSize) const uint8_t * dds_data,
    _In_ size_t dds_dataSize,
    _In_ size_t maxsize,
    _In_ D3D11_USAGE usage,
    _In_ uint32_t bindFlags,
    _In_ uint32_t cpu_access_flags,
    _In_ uint32_t misc_flags,
    _In_ bool forceSRGB,
    _Outptr_opt_ ID3D11Resource ** texture,
    _Outptr_opt_ ID3D11ShaderResourceView ** texture_view,
    _Out_opt_ DDS_ALPHA_MODE * alpha_mode = nullptr )
```

4.1.3.107 CreateDDSTextureFromMemoryEx() [3/4]

```
_Use_decl_annotations_ HRESULT mage::CreateDDSTextureFromMemoryEx (
    ID3D11Device2 * device,
    const uint8_t * dds_data,
    size_t dds_dataSize,
    size_t maxsize,
    D3D11_USAGE usage,
    uint32_t bindFlags,
    uint32_t cpu_access_flags,
    uint32_t misc_flags,
    bool forceSRGB,
    ID3D11Resource ** texture,
    ID3D11ShaderResourceView ** texture_view,
    DDS_ALPHA_MODE * alpha_mode )
```

4.1.3.108 CreateDDSTextureFromMemoryEx() [4/4]

```
_Use_decl_annotations_ HRESULT mage::CreateDDSTextureFromMemoryEx (
    ID3D11Device2 * device,
    ID3D11DeviceContext * device_context,
    const uint8_t * dds_data,
    size_t dds_dataSize,
    size_t maxsize,
    D3D11_USAGE usage,
    uint32_t bindFlags,
    uint32_t cpu_access_flags,
    uint32_t misc_flags,
    bool forceSRGB,
    ID3D11Resource ** texture,
    ID3D11ShaderResourceView ** texture_view,
    DDS_ALPHA_MODE * alpha_mode )
```

4.1.3.109 CreateDepthDefaultDepthStencilState()

```
HRESULT mage::CreateDepthDefaultDepthStencilState (
    ID3D11Device2 * device,
    ID3D11DepthStencilState ** depth_stencil_state )
```

4.1.3.110 CreateDepthNoneDepthStencilState()

```
HRESULT mage::CreateDepthNoneDepthStencilState (
    ID3D11Device2 * device,
    ID3D11DepthStencilState ** depth_stencil_state )
```

4.1.3.111 CreateDepthReadDepthStencilState()

```
HRESULT mage::CreateDepthReadDepthStencilState (
    ID3D11Device2 * device,
    ID3D11DepthStencilState ** depth_stencil_state )
```

4.1.3.112 CreateDepthStencilState()

```
HRESULT mage::CreateDepthStencilState (
    ID3D11Device2 * device,
    ID3D11DepthStencilState ** depth_stencil_state,
    bool enable,
    bool write_enable )
```

4.1.3.113 CreateDiffuseShader()

```
const CombinedShader mage::CreateDiffuseShader ( )
```

Creates a diffuse shader.

Precondition

The current engine must be loaded.

Returns

The diffuse shader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the lambertian shader. |
|---------------------------|---|

4.1.3.114 CreateDynamicVertexBuffer()

```
template<typename VertexT >
HRESULT mage::CreateDynamicVertexBuffer (
    ID3D11Device2 * device,
    ID3D11Buffer ** buffer,
    const VertexT * vertices,
    size_t nb_vertices )
```

4.1.3.115 CreateFont()

```
SharedPtr< SpriteFont > mage::CreateFont (
    const wstring & fname,
    const SpriteFontDescriptor & desc )
```

Creates a sprite font.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|--------------|--|
| in | <i>fname</i> | A reference to the filename. |
| in | <i>desc</i> | A reference to the sprite font descriptor. |

Returns

A pointer to the sprite font.

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to create the sprite font. |
|---------------------------|-----------------------------------|

4.1.3.116 CreateLambertianShader()

```
const CombinedShader mage::CreateLambertianShader ( )
```

Creates a Lambertian shader.

Precondition

The current engine must be loaded.

Returns

The Lambertian shader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the lambertian shader. |
|---------------------------|---|

4.1.3.117 CreateLinearClampSamplerState()

```
HRESULT mage::CreateLinearClampSamplerState (
```

```
ID3D11Device2 * device,
ID3D11SamplerState ** sampler_state )
```

4.1.3.118 CreateLinearWrapSamplerState()

```
HRESULT mage::CreateLinearWrapSamplerState (
    ID3D11Device2 * device,
    ID3D11SamplerState ** sampler_state )
```

4.1.3.119 CreateModelDescriptor()

```
template<typename VertexT >
SharedPtr< ModelDescriptor > mage::CreateModelDescriptor (
    const wstring & fname,
    const MeshDescriptor< VertexT > & desc )
```

Creates a model descriptor.

Precondition

The current engine must be loaded.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

Parameters

| | | |
|----|--------------|-------------------------------------|
| in | <i>fname</i> | A reference to the filename. |
| in | <i>desc</i> | A reference to the mesh descriptor. |

Returns

A pointer to the model descriptor.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to initialize the model descriptor. |
|---------------------------|--|

4.1.3.120 CreateModifiedBlinnPhongShader()

```
const CombinedShader mage::CreateModifiedBlinnPhongShader ( )
```

Creates a Modified Blinn-Phong shader.

Precondition

The current engine must be loaded.

Returns

The Modified Blinn-Phong shader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the lambertian shader. |
|---------------------------|---|

4.1.3.121 CreateNonPremultipliedBlendState()

```
HRESULT mage::CreateNonPremultipliedBlendState (
    ID3D11Device2 * device,
    ID3D11BlendState ** blend_state )
```

4.1.3.122 CreateOpaqueBlendState()

```
HRESULT mage::CreateOpaqueBlendState (
    ID3D11Device2 * device,
    ID3D11BlendState ** blend_state )
```

4.1.3.123 CreateOrthographicCamera()

```
UniquePtr< OrthographicCamera > mage::CreateOrthographicCamera (
    float width = MAGE_DEFAULT_CAMERA_ORTHOGRAPHIC_WIDTH,
    float height = MAGE_DEFAULT_CAMERA_ORTHOGRAPHIC_HEIGHT,
    float near_z = MAGE_DEFAULT_CAMERA_NEAR_Z,
    float far_z = MAGE_DEFAULT_CAMERA_FAR_Z )
```

Constructs an orthographic camera.

Parameters

| | | |
|----|---------------|--|
| in | <i>width</i> | The width of the camera projection plane in camera space. |
| in | <i>height</i> | The height of the camera projection plane in camera space. |
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
| in | <i>far_z</i> | The position of the far z-plane in camera space. |

4.1.3.124 CreatePerspectiveCamera()

```
UniquePtr< PerspectiveCamera > mage::CreatePerspectiveCamera (
    float fov_y = MAGE_DEFAULT_CAMERA_PERSPECTIVE_FOV_Y,
```

```
float near_z = MAGE_DEFAULT_CAMERA_NEAR_Z,
float far_z = MAGE_DEFAULT_CAMERA_FAR_Z )
```

Constructs a perspective camera.

The aspect ratio will be based on the current screen resolution.

Precondition

The current engine and its renderer must exist.

Parameters

| | | |
|----|---------------|---|
| in | <i>fov_y</i> | The vertical field-of-view. |
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
| in | <i>far_z</i> | The position of the far z-plane in camera space. |

4.1.3.125 CreatePhongShader()

```
const CombinedShader mage::CreatePhongShader ( )
```

Creates a Phong shader.

Precondition

The current engine must be loaded.

Returns

The Phong shader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the lambertian shader. |
|---------------------------|---|

4.1.3.126 CreatePointClampSamplerState()

```
HRESULT mage::CreatePointClampSamplerState (
    ID3D11Device2 * device,
    ID3D11SamplerState ** sampler_state )
```

4.1.3.127 CreatePointWrapSamplerState()

```
HRESULT mage::CreatePointWrapSamplerState (
    ID3D11Device2 * device,
    ID3D11SamplerState ** sampler_state )
```

4.1.3.128 CreateRasterizerState()

```
HRESULT mage::CreateRasterizerState (
    ID3D11Device2 * device,
    ID3D11RasterizerState ** rasterizer_state,
    D3D11_CULL_MODE cull_mode,
    D3D11_FILL_MODE fill_mode )
```

4.1.3.129 CreateSamplerState()

```
HRESULT mage::CreateSamplerState (
    ID3D11Device2 * device,
    ID3D11SamplerState ** sampler_state,
    D3D11_FILTER filter,
    D3D11_TEXTURE_ADDRESS_MODE address_mode )
```

4.1.3.130 CreateSharedHandle()

```
SharedHandle mage::CreateSharedHandle (
    HANDLE handle )
```

Creates a shared handle for the given handle.

Parameters

| | | |
|----|--------|-----------|
| in | handle | A handle. |
|----|--------|-----------|

Returns

A shared handle for the given handle *handle*.

4.1.3.131 CreateSpriteShader()

```
const CombinedShader mage::CreateSpriteShader ( )
```

Creates a sprite shader.

Precondition

The current engine must be loaded.

Returns

The sprite shader.

Exceptions

| | |
|--------------------|-------------------------------------|
| FormattedException | Failed to create the sprite shader. |
|--------------------|-------------------------------------|

4.1.3.132 CreateStaticIndexBuffer()

```
template<typename IndexT >
HRESULT mage::CreateStaticIndexBuffer (
    ID3D11Device2 * device,
    ID3D11Buffer ** buffer,
    const IndexT * indices,
    size_t nb_indices )
```

4.1.3.133 CreateStaticVertexBuffer()

```
template<typename VertexT >
HRESULT mage::CreateStaticVertexBuffer (
    ID3D11Device2 * device,
    ID3D11Buffer ** buffer,
    const VertexT * vertices,
    size_t nb_vertices )
```

4.1.3.134 CreateStructuredBuffer()

```
template<typename DataT >
HRESULT mage::CreateStructuredBuffer (
    ID3D11Device2 * device,
    ID3D11Buffer ** buffer,
    size_t count = 1 )
```

4.1.3.135 CreateTexture()

```
SharedPtr< Texture > mage::CreateTexture (
    const wstring & fname )
```

Creates a texture.

Precondition

The current engine must be loaded.

Parameters

| | | |
|----|--------------|------------------------------|
| in | <i>fname</i> | A reference to the filename. |
|----|--------------|------------------------------|

Returns

A pointer to the texture.

Exceptions

| | |
|---------------------------|-------------------------------|
| <i>FormattedException</i> | Failed to create the texture. |
|---------------------------|-------------------------------|

4.1.3.136 CreateTextureFromDDS()

```
static HRESULT mage::CreateTextureFromDDS (
    _In_ ID3D11Device2 * device,
    _In_opt_ ID3D11DeviceContext * device_context,
    _In_ const DDS_HEADER * header,
    _In_reads_bytes_(bit_size) const uint8_t * bit_data,
    _In_ size_t bit_size,
    _In_ size_t maxsize,
    _In_ D3D11_USAGE usage,
    _In_ uint32_t bindFlags,
    _In_ uint32_t cpu_access_flags,
    _In_ uint32_t misc_flags,
    _In_ bool forceSRGB,
    _Outptr_opt_ ID3D11Resource ** texture,
    _Outptr_opt_ ID3D11ShaderResourceView ** texture_view ) [static]
```

4.1.3.137 CreateVariableScript()

```
SharedPtr< VariableScript > mage::CreateVariableScript (
    const wstring & fname,
    bool import = true )
```

Creates a variable script.

Parameters

| | | |
|----|---------------|---|
| in | <i>fname</i> | A reference to the filename of the variable script. |
| in | <i>import</i> | Flag indicating whether the variables of the variable script need to be imported. |

Returns

A pointer to the variable script.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to import the variable script from file (only possible if <i>import</i> is equal to <code>true</code>). |
|---------------------------|---|

4.1.3.138 CreateWhiteTexture()

```
SharedPtr< Texture > mage::CreateWhiteTexture ( )
```

Creates a white texture.

Precondition

- The current engine must be loaded.
- The standard assets must be present.

Returns

A pointer to the texture.

Exceptions

| | |
|---------------------------|-------------------------------|
| <i>FormattedException</i> | Failed to create the texture. |
|---------------------------|-------------------------------|

4.1.3.139 CreateWireframeRasterizerState()

```
HRESULT mage::CreateWireframeRasterizerState (
    ID3D11Device2 * device,
    ID3D11RasterizerState ** rasterizer_state )
```

4.1.3.140 Debug()

```
void mage::Debug (
    const char * format,
    ...
)
```

Notifies a debug message.

A debug message is associated with generally useful information to log only in debug builds.

Precondition

format is not equal to `nullptr`.

Parameters

| | | |
|-----------|---------------|--------------------------------|
| <i>in</i> | <i>format</i> | Pointer to the message format. |
|-----------|---------------|--------------------------------|

4.1.3.141 DestructHandle()

```
void mage::DestructHandle (
    HANDLE handle )
```

Destructs the given handle.

Parameters

| | | |
|-----------|---------------|-------------------------|
| <i>in</i> | <i>handle</i> | The handle to destruct. |
|-----------|---------------|-------------------------|

4.1.3.142 dynamic_pointer_cast()

```
template<typename T , typename U >
UniquePtr< T > mage::dynamic_pointer_cast (
    UniquePtr< U > && ptr )
```

Creates a unique pointer whose stored pointer is obtained by dynamically casting the stored pointer of the given unique pointer.

Template Parameters

| | |
|----------|---------------------------|
| <i>T</i> | The conversion to-type. |
| <i>U</i> | The conversion from-type. |

Parameters

| | | |
|----|------------|-----------------------------|
| in | <i>ptr</i> | The unique pointer to move. |
|----|------------|-----------------------------|

Returns

The moved unique pointer.

4.1.3.143 Error()

```
void mage::Error (
    const char * format,
    ...
)
```

Notifies an error message.

An error message is associated with any error which is fatal to the operation, but not the service or application.

Precondition

format is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|--------------------------------|
| in | <i>format</i> | Pointer to the message format. |
|----|---------------|--------------------------------|

4.1.3.144 ExportMDLModelToFile()

```
template<typename VertexT >
void mage::ExportMDLModelToFile (
    const wstring & fname,
    const ModelOutput< VertexT > & model_output )
```

Exports the given model to the given MDL file.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

Parameters

| | | |
|----|--------------|----------------------------------|
| in | <i>fname</i> | A reference to the MDL filename. |
|----|--------------|----------------------------------|

Parameters

| | | |
|----|---------------------|----------------------------------|
| in | <i>model_output</i> | A reference to the model output. |
|----|---------------------|----------------------------------|

Exceptions

| | |
|---------------------------|-------------------------------------|
| <i>FormattedException</i> | Failed to export the model to file. |
|---------------------------|-------------------------------------|

4.1.3.145 ExportModelToFile()

```
template<typename VertexT >
void mage::ExportModelToFile (
    const wstring & fname,
    const ModelOutput< VertexT > & model_output )
```

Exports the model to the given file.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

Parameters

| | | |
|----|---------------------|----------------------------------|
| in | <i>fname</i> | A reference to the filename. |
| in | <i>model_output</i> | A reference to the model output. |

Exceptions

| | |
|---------------------------|-------------------------------------|
| <i>FormattedException</i> | Failed to export the model to file. |
|---------------------------|-------------------------------------|

4.1.3.146 ExportMSHMeshToFile()

```
template<typename VertexT , typename IndexT >
void mage::ExportMSHMeshToFile (
    const wstring & fname,
    const vector< VertexT > & vertices,
    const vector< IndexT > & indices )
```

Exports the given mesh to the given MSH file.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
| <i>IndexT</i> | The index type. |

Parameters

| | | |
|----|-----------------|--|
| in | <i>fname</i> | A reference to the MSH filename. |
| in | <i>vertices</i> | A reference to a vector containing the vertices of the mesh. |
| in | <i>indices</i> | A reference to a vector containing the indices of the mesh. |

Exceptions

| | |
|---------------------------|------------------------------------|
| <i>FormattedException</i> | Failed to export the mesh to file. |
|---------------------------|------------------------------------|

4.1.3.147 ExportVariableScriptToFile()

```
void mage::ExportVariableScriptToFile (
    const wstring & fname,
    const vector< Variable > & variable_buffer )
```

Exports the given variables to the given file.

Parameters

| | | |
|----|------------------------|---|
| in | <i>fname</i> | A reference to the filename. |
| in | <i>variable_buffer</i> | A reference to a vector containing the variables. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to export the variable script to file. |
|---------------------------|---|

4.1.3.148 ExportVSToFile()

```
void mage::ExportVSToFile (
    const wstring & fname,
    const vector< Variable > & variable_buffer )
```

Exports the given variables to the given VS file.

Parameters

| | | |
|----|------------------------|---|
| in | <i>fname</i> | A reference to the VS filename. |
| in | <i>variable_buffer</i> | A reference to a vector containing the variables. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to export the variable script to file. |
|---------------------------|---|

4.1.3.149 Fatal()

```
void mage::Fatal (
    const char * format,
    ...
)
```

Notifies a fatal message.

A fatal message is associated with any error that is forcing a shutdown of the service or application to prevent data loss (or further data loss).

Precondition

format is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|--------------------------------|
| in | <i>format</i> | Pointer to the message format. |
|----|---------------|--------------------------------|

4.1.3.150 FileExists()

```
bool mage::FileExists (
    const wstring & fname )
```

Checks whether a file with the given filename exists.

Parameters

| | | |
|----|--------------|--|
| in | <i>fname</i> | A reference to the filename of the file. |
|----|--------------|--|

Returns

`true` if a file with the given filename exists. `false` otherwise.

4.1.3.151 FillInitData()

```
static HRESULT mage::FillInitData (
    _In_ size_t width,
    _In_ size_t height,
    _In_ size_t depth,
    _In_ size_t mip_count,
    _In_ size_t array_size,
    _In_ DXGI_FORMAT format,
    _In_ size_t maxsize,
    _In_ size_t bit_size,
    _In_reads_bytes_(bit_size) const uint8_t * bit_data,
    _Out_ size_t & twidth,
    _Out_ size_t & theight,
    _Out_ size_t & tdepth,
    _Out_ size_t & skip_mip,
    _Out_writes_(mip_count *array_size) D3D11_SUBRESOURCE_DATA * init_data ) [static]
```

4.1.3.152 FindWordEnd()

```
static const char* mage::FindWordEnd (
    const char * buffer ) [static]
```

Finds the end of a word.

Precondition

buffer is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|-----------------------------------|
| in | <i>buffer</i> | A pointer to the first character. |
|----|---------------|-----------------------------------|

Returns

A pointer to the end of the word. (i.e. pointer to a space or null-terminating character)

4.1.3.153 FreeAligned()

```
void mage::FreeAligned (
    void * ptr )
```

Frees a block of memory that was allocated with `mage::AllocAligned(size_t)` or `mage::AllocAligned<T>(size_t)`.

Parameters

| | | |
|----|------------|---|
| in | <i>ptr</i> | A pointer to the memory block that was allocated. |
|----|------------|---|

4.1.3.154 GetAlphaMode()

```
static DDS_ALPHA_MODE mage::GetAlphaMode (
    _In_ const DDS_HEADER * header ) [static]
```

4.1.3.155 GetCurrentCoreTimestamp() [1/2]

```
void mage::GetCurrentCoreTimestamp (
    HANDLE handle_process,
    uint64_t * kernel_mode_timestamp,
    uint64_t * user_mode_timestamp )
```

Returns the current core timestamp (in 100 ns).

Precondition

handle_process is not equal to `nullptr`.
kernel_mode_timestamp is not equal to `nullptr`.
user_mode_timestamp is not equal to `nullptr`.
handle_process must have the `PROCESS_QUERY_INFORMATION` or `PROCESS_QUERY_LIMITED_INFORMATION` access right.

Parameters

| | | |
|-----|------------------------------|--|
| in | <i>handle_process</i> | A handle to the process whose timing information is sought. |
| out | <i>kernel_mode_timestamp</i> | A pointer to the current kernel mode timestamp of the given process. |
| out | <i>user_mode_timestamp</i> | A pointer to the current user mode timestamp of the given process. |

Note

If the retrieval fails, both *kernel_mode_timestamp* and *user_mode_timestamp* point to zero. To get extended error information, call GetLastError.

4.1.3.156 GetCurrentCoreTimestamp() [2/2]

```
void mage::GetCurrentCoreTimestamp (
    uint64_t * kernel_mode_timestamp,
    uint64_t * user_mode_timestamp )
```

Returns the current core timestamp (in 100 ns).

Precondition

kernel_mode_timestamp is not equal to `nullptr`.
user_mode_timestamp is not equal to `nullptr`.

Parameters

| | | |
|-----|------------------------------|--|
| out | <i>kernel_mode_timestamp</i> | A pointer to the current kernel mode timestamp of the calling process. |
| out | <i>user_mode_timestamp</i> | A pointer to the current user mode timestamp of the calling process. |

Note

If the retrieval fails, both *kernel_mode_timestamp* and *user_mode_timestamp* point to zero. To get extended error information, call GetLastError.

4.1.3.157 GetCurrentSystemTimestamp()

```
uint64_t mage::GetCurrentSystemTimestamp ( )
```

Returns the current system timestamp (in 100 ns).

Returns

The current system timestamp (in 100 ns).

4.1.3.158 GetDXGIFormat()

```
static DXGI_FORMAT mage::GetDXGIFormat (
    const DDS_PIXELFORMAT & ddpf ) [static]
```

4.1.3.159 GetFileExtension() [1/2]

```
const string mage::GetFileExtension (
    const string & fname )
```

Returns the extension of the given file.

Parameters

| | | |
|----|--------------|--|
| in | <i>fname</i> | A reference to the filename of the file. |
|----|--------------|--|

Returns

The extension of the given file.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | The filename does not have a file extension. |
|---------------------------|--|

4.1.3.160 GetFileExtension() [2/2]

```
const wstring mage::GetFileExtension (
    const wstring & fname )
```

Returns the extension of the given file.

Parameters

| | | |
|----|--------------|--|
| in | <i>fname</i> | A reference to the filename of the file. |
|----|--------------|--|

Returns

The extension of the given file.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | The filename does not have a file extension. |
|---------------------------|--|

4.1.3.161 GetFilename() [1/2]

```
const string mage::GetFilename (
    const string & path,
    const string & name )
```

Returns the filename of the given file.

Precondition

The path must end with a '/' character.

Parameters

| | | |
|----|-------------|--------------------------------------|
| in | <i>path</i> | A reference to the path of the file. |
| in | <i>name</i> | A reference to the name of the file. |

Returns

The filename of the given file.

4.1.3.162 GetFilename() [2/2]

```
const wstring mage::GetFilename (
    const wstring & path,
    const wstring & name )
```

Returns the filename of the given file.

Precondition

The path must end with a '/' character.

Parameters

| | | |
|----|-------------|--------------------------------------|
| in | <i>path</i> | A reference to the path of the file. |
| in | <i>name</i> | A reference to the name of the file. |

Returns

The filename of the given file.

4.1.3.163 GetFileName() [1/2]

```
const string mage::GetFileName (
    const string & fname )
```

Returns the name of the given file.

Parameters

| | | |
|----|--------------|--|
| in | <i>fname</i> | A reference to the filename of the file. |
|----|--------------|--|

Returns

The name of the given file.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | The filename does not have a file path. |
|---------------------------|---|

4.1.3.164 GetFileName() [2/2]

```
const wstring mage::GetFileName (
    const wstring & fname )
```

Returns the name of the given file.

Parameters

| | | |
|-----------|--------------|--|
| <i>in</i> | <i>fname</i> | A reference to the filename of the file. |
|-----------|--------------|--|

Returns

The name of the given file.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | The filename does not have a file path. |
|---------------------------|---|

4.1.3.165 GetFilenameWithoutFileExtension() [1/2]

```
const string mage::GetFilenameWithoutFileExtension (
    const string & fname )
```

Returns the filename of the given file without its file extension.

Parameters

| | | |
|-----------|--------------|--|
| <i>in</i> | <i>fname</i> | A reference to the filename of the file. |
|-----------|--------------|--|

Returns

The filename of the given file without its file extension.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | The filename does not have a file path. |
|---------------------------|---|

4.1.3.166 GetFilenameWithoutFileExtension() [2/2]

```
const wstring mage::GetFilenameWithoutFileExtension (
    const wstring & fname )
```

Returns the filename of the given file without its file extension.

Parameters

| | | |
|----|--------------|--|
| in | <i>fname</i> | A reference to the filename of the file. |
|----|--------------|--|

Returns

The filename of the given file without its file extension.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | The filename does not have a file path. |
|---------------------------|---|

4.1.3.167 GetModelRenderingDevice()

```
ID3D11Device2* mage::GetModelRenderingDevice ( )
```

4.1.3.168 GetModelRenderingContext()

```
ID3D11DeviceContext2* mage::GetModelRenderingContext ( )
```

4.1.3.169 GetModelResourceFactory()

```
ResourceFactory* mage::GetModelResourceFactory ( )
```

4.1.3.170 GetPathName() [1/2]

```
const string mage::GetPathName (
    const string & fname )
```

Returns the path of the given file.

Parameters

| | | |
|----|--------------|--|
| in | <i>fname</i> | A reference to the filename of the file. |
|----|--------------|--|

Returns

The path of the given file.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | The filename does not have a file path. |
|---------------------------|---|

4.1.3.171 GetPathName() [2/2]

```
const wstring mage::GetPathName (
    const wstring & fname )
```

Returns the path of the given file.

Parameters

| | | |
|-----------|--------------|--|
| <i>in</i> | <i>fname</i> | A reference to the filename of the file. |
|-----------|--------------|--|

Returns

The path of the given file.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | The filename does not have a file path. |
|---------------------------|---|

4.1.3.172 GetPhysicalMemoryUsage()

```
uint64_t mage::GetPhysicalMemoryUsage ( )
```

Retrieves the current working set size (in bytes) of the running process.

Returns

If the retrieval fails, the return value is zero. To get extended error information, call GetLastError.
If the retrieval succeeds, the total physical memory usage of this process (in bytes).

4.1.3.173 GetRefreshRate()

```
unsigned int mage::GetRefreshRate (
    const DXGI_MODE_DESC1 & desc )
```

Returns the refresh rate of the given display format descriptor.

Parameters

| | | |
|-----------|-------------|---|
| <i>in</i> | <i>desc</i> | A reference to the display format descriptor. |
|-----------|-------------|---|

Returns

The refresh rate of the given display format descriptor.

4.1.3.174 GetRenderingDevice()

```
ID3D11Device2 * mage::GetRenderingDevice ( )
```

Returns the rendering device.

Precondition

The current engine must be loaded.

Returns

A pointer to the rendering device.

4.1.3.175 GetRenderingContext()

```
ID3D11DeviceContext2 * mage::GetRenderingContext ( )
```

Returns the rendering device context.

Precondition

The current engine must be loaded.

Returns

A pointer to the rendering device context.

4.1.3.176 GetResourceFactory()

```
ResourceFactory * mage::GetResourceFactory ( )
```

Returns the resource factory.

Precondition

The current engine must be loaded.

Returns

A pointer to the resource factory.

4.1.3.177 GetSurfaceInfo()

```
static void mage::GetSurfaceInfo (
    _In_ size_t width,
    _In_ size_t height,
    _In_ DXGI_FORMAT fmt,
    _Out_opt_ size_t * out_nb_bytes,
    _Out_opt_ size_t * out_row_bytes,
    _Out_opt_ size_t * out_nb_rows ) [static]
```

4.1.3.178 GetTexture2DSize()

```
const XMVECTOR mage::GetTexture2DSize (
    ID3D11ShaderResourceView * texture )
```

Returns the size of the given 2D texture.

Precondition

texture is not equal to `nullptr`.

Parameters

| | | |
|----|----------------|---|
| in | <i>texture</i> | A pointer the (texture) shader resource view. |
|----|----------------|---|

Returns

The size of the given 2D texture as a `XMVECTOR` (`width, height, width, height`).

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | The resource of the given shader resource view must be convertible to a <code>ID3D11Texture2D</code> . |
|---------------------------|--|

4.1.3.179 GetViewportTransform() [1/3]

```
const XMMATRIX mage::GetViewportTransform (
    ID3D11DeviceContext * device_context,
    DXGI_MODE_ROTATION rotation_mode )
```

Returns the viewport transform for the given device context and rotation mode.

Precondition

device_context is not equal to `nullptr`.

Parameters

| | | |
|----|-----------------------|----------------------------------|
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>rotation_mode</i> | The rotation mode. |

Returns

The viewport transform for the given device context and rotation mode.

Exceptions

| | |
|---------------------------|-----------------------------|
| <i>FormattedException</i> | A viewport needs to be set. |
|---------------------------|-----------------------------|

4.1.3.180 GetViewportTransform() [2/3]

```
const XMMATRIX mage::GetViewportTransform (
    ID3D11DeviceContext * device_context,
    DXGI_MODE_ROTATION rotation_mode,
    D3D11_VIEWPORT * viewport )
```

Returns the viewport transform for the given device context and rotation mode.

Precondition

device_context is not equal to `nullptr`.
viewport is not equal to `nullptr`.

Parameters

| | | |
|-----|-----------------------|----------------------------------|
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>rotation_mode</i> | The rotation mode. |
| out | <i>viewport</i> | A pointer to the viewport. |

Returns

The viewport transform for the given device context and rotation mode.

Exceptions

| | |
|---------------------------|-----------------------------|
| <i>FormattedException</i> | A viewport needs to be set. |
|---------------------------|-----------------------------|

4.1.3.181 GetViewportTransform() [3/3]

```
const XMMATRIX mage::GetViewportTransform (
    const D3D11_VIEWPORT & viewport,
    DXGI_MODE_ROTATION rotation_mode )
```

Returns the viewport transform for the viewport and rotation mode.

Parameters

| | | |
|----|----------------------|------------------------------|
| in | <i>viewport</i> | A reference to the viewport. |
| in | <i>rotation_mode</i> | The rotation mode. |

Returns

The viewport transform for the given viewport and rotation mode.

4.1.3.182 GetVirtualMemoryUsage()

```
uint64_t mage::GetVirtualMemoryUsage ( )
```

Retrieves the total amount of memory (in bytes) that the memory manager has committed to the running process.

Returns

If the retrieval fails, the return value is zero. To get extended error information, call GetLastError.

If the retrieval succeeds, the total virtual memory usage of this process (in bytes).

4.1.3.183 GotoDelimiters() [1/2]

```
char * mage::GotoDelimiters (
    char * str,
    const char * delimiters = mage_default_delimiters )
```

Advances to the first delimiting character in the given string.

Precondition

str is not equal to nullptr.

delimiters is not equal to nullptr.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

nullptr if the end of string character is reached.

A pointer to the first delimiting character in the given string.

4.1.3.184 GotoDelimiters() [2/2]

```
const char * mage::GotoDelimiters (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Advances to the first delimiting character in the given string.

Precondition

str is not equal to nullptr.

delimiters is not equal to nullptr.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

`nullptr` if the end of string character is reached.
A pointer to the first delimiting character in the given string.

4.1.3.185 HasBool()

```
TokenResult mage::HasBool (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `bool`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `bool` succeeds or not.

4.1.3.186 HasChars()

```
TokenResult mage::HasChars (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents (non-delimiting) characters.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `uint32_t` succeeds or not.

4.1.3.187 HasDouble()

```
TokenResult mage::HasDouble (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `double`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `double` succeeds or not.

4.1.3.188 HasFloat()

```
TokenResult mage::HasFloat (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `float`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `float` succeeds or not.

4.1.3.189 HasInt16()

```
TokenResult mage::HasInt16 (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `int16_t`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `int16_t` succeeds or not.

4.1.3.190 HasInt32()

```
TokenResult mage::HasInt32 (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `int32_t`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `int32_t` succeeds or not.

4.1.3.191 HasInt64()

```
TokenResult mage::HasInt64 (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `int64_t`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `int64_t` succeeds or not.

4.1.3.192 HasInt8()

```
TokenResult mage::HasInt8 (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `uint8_t`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `int8_t` succeeds or not.

4.1.3.193 HasQuotedString()

```
TokenResult mage::HasQuotedString (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a quoted string.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.
The quote `""` may not be delimiter.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a quoted string succeeds or not.

4.1.3.194 HasString()

```
TokenResult mage::HasString (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a string.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a string succeeds or not.

4.1.3.195 HasUInt16()

```
TokenResult mage::HasUInt16 (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `uint16_t`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `uint16_t` succeeds or not.

4.1.3.196 HasUInt32()

```
TokenResult mage::HasUInt32 (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `uint32_t`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `uint32_t` succeeds or not.

4.1.3.197 HasUInt64()

```
TokenResult mage::HasUInt64 (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `uint64_t`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `uint64_t` succeeds or not.

4.1.3.198 HasUInt8()

```
TokenResult mage::HasUInt8 (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Checks whether the next token in the given string represents a `uint8_t`.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `uint8_t` succeeds or not.

4.1.3.199 ImportFontFromFile()

```
void mage::ImportFontFromFile (
    const wstring & fname,
    ID3D11Device2 * device,
    SpriteFontOutput & output,
    const SpriteFontDescriptor & desc = SpriteFontDescriptor() )
```

Imports the SPRITEFONT from the given file.

Precondition

device is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------|--|
| in | <i>fname</i> | A reference to the SPRITEFONT filename. |
| in | <i>device</i> | A pointer to the device. |
| out | <i>output</i> | A reference to the sprite font output. |
| in | <i>desc</i> | A reference to the sprite font descriptor. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to import the sprite font from file. |
|---------------------------|---|

4.1.3.200 ImportMaterialFromFile()

```
void mage::ImportMaterialFromFile (
    const wstring & fname,
    vector< Material > & materials )
```

Imports the materials from the given file.

Parameters

| | | |
|-----|------------------|---|
| in | <i>fname</i> | A reference to the filename. |
| out | <i>materials</i> | A reference to a vector containing the materials. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to import the materials from file. |
|---------------------------|---|

4.1.3.201 ImportMDLModelFromFile()

```
template<typename VertexT >
void mage::ImportMDLModelFromFile (
    const wstring & fname,
    ModelOutput< VertexT > & model_output )
```

Imports the model from the given MDL file.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

Parameters

| | | |
|-----|---------------------|----------------------------------|
| in | <i>fname</i> | A reference to the MDL filename. |
| out | <i>model_output</i> | A reference to the model output. |

Exceptions

| | |
|---------------------------|---------------------------------------|
| <i>FormattedException</i> | Failed to import the model from file. |
|---------------------------|---------------------------------------|

4.1.3.202 ImportModelFromFile()

```
template<typename VertexT >
void mage::ImportModelFromFile (
    const wstring & fname,
    ModelOutput< VertexT > & model_output,
    const MeshDescriptor< VertexT > & mesh_desc = MeshDescriptor< VertexT >() )
```

Imports the model from the given file.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

Parameters

| | | |
|---------|---------------------|-------------------------------------|
| in | <i>fname</i> | A reference to the filename. |
| in, out | <i>model_output</i> | A reference to the model output. |
| in | <i>mesh_desc</i> | A reference to the mesh descriptor. |

Exceptions

| | |
|---------------------------|---------------------------------------|
| <i>FormattedException</i> | Failed to import the model from file. |
|---------------------------|---------------------------------------|

4.1.3.203 ImportMSHMeshFromFile()

```
template<typename VertexT , typename IndexT >
void mage::ImportMSHMeshFromFile (
    const wstring & fname,
    vector< VertexT > & vertices,
    vector< IndexT > & indices )
```

Imports the mesh from the given MSH file.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
| <i>IndexT</i> | The index type. |

Parameters

| | | |
|-----|-----------------|--|
| in | <i>fname</i> | A reference to the MSH filename. |
| out | <i>vertices</i> | A reference to a vector containing the vertices of the mesh. |
| out | <i>indices</i> | A reference to a vector containing the indices of the mesh. |

Exceptions

| | |
|---------------------------|--------------------------------------|
| <i>FormattedException</i> | Failed to import the mesh from file. |
|---------------------------|--------------------------------------|

4.1.3.204 ImportMTLMaterialFromFile()

```
void mage::ImportMTLMaterialFromFile (
    const wstring & fname,
    vector< Material > & materials )
```

Imports the materials from the given MTL file.

Parameters

| | | |
|-----|------------------|---|
| in | <i>fname</i> | A reference to the MTL filename. |
| out | <i>materials</i> | A reference to a vector containing the materials. |

Exceptions

| | |
|---------------------------|--------------------------------------|
| <i>FormattedException</i> | Failed to import the mesh from file. |
|---------------------------|--------------------------------------|

4.1.3.205 ImportOBJMeshFromFile()

```
template<typename VertexT >
void mage::ImportOBJMeshFromFile (
    const wstring & fname,
    ModelOutput< VertexT > & model_output,
    const MeshDescriptor< VertexT > & mesh_desc = MeshDescriptor< VertexT >() )
```

Imports a mesh from the given OBJ file.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

Parameters

| | | |
|---------|---------------------|-------------------------------------|
| in | <i>fname</i> | A reference to the OBJ filename. |
| in, out | <i>model_output</i> | A reference to the model output. |
| in | <i>mesh_desc</i> | A reference to the mesh descriptor. |

Exceptions

| | |
|---------------------------|--------------------------------------|
| <i>FormattedException</i> | Failed to import the mesh from file. |
|---------------------------|--------------------------------------|

4.1.3.206 ImportSpriteFontFromFile()

```
void mage::ImportSpriteFontFromFile (
    const wstring & fname,
    ID3D11Device2 * device,
    SpriteFontOutput & output,
    const SpriteFontDescriptor & desc = SpriteFontDescriptor() )
```

Imports the sprite font from the given file.

Precondition

device is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------|--|
| in | <i>fname</i> | A reference to the filename. |
| in | <i>device</i> | A pointer to the device. |
| out | <i>output</i> | A reference to the sprite font output. |
| in | <i>desc</i> | A reference to the sprite font descriptor. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to import the sprite font from file. |
|---------------------------|---|

4.1.3.207 ImportTextureFromFile()

```
void mage::ImportTextureFromFile (
    const wstring & fname,
    ID3D11Device2 * device,
    ID3D11ShaderResourceView ** texture_srv )
```

Imports the texture from the given file.

Precondition

device is not equal to `nullptr`.
texture_resource_view is not equal to `nullptr`.

Parameters

| | | |
|-----|--------------------|---|
| in | <i>fname</i> | A reference to the filename. |
| in | <i>device</i> | A pointer to the device. |
| out | <i>texture_srv</i> | A pointer to a pointer to a shader resource view. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to import the texture from file. |
|---------------------------|---|

4.1.3.208 ImportVariableScriptFromFile()

```
void mage::ImportVariableScriptFromFile (
    const wstring & fname,
    vector< Variable > & variable_buffer )
```

Imports the variables from the given file.

Parameters

| | | |
|---------|------------------------|---|
| in | <i>fname</i> | A reference to the filename. |
| in, out | <i>variable_buffer</i> | A reference to a vector containing the variables. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to import the variable script from file. |
|---------------------------|---|

4.1.3.209 ImportVSFromFile()

```
void mage::ImportVSFromFile (
    const wstring & fname,
    vector< Variable > & variable_buffer )
```

Imports the variables from the given VS file.

Parameters

| | | |
|-----|------------------------|---|
| in | <i>fname</i> | A reference to the VS filename. |
| out | <i>variable_buffer</i> | A reference to a vector containing the variables. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to import the variable script from file. |
|---------------------------|---|

4.1.3.210 Info()

```
void mage::Info (
    const char * format,
    ...
)
```

Notifies an info message.

An info message is associated with generally useful information to log.

Precondition

format is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|--------------------------------|
| in | <i>format</i> | Pointer to the message format. |
|----|---------------|--------------------------------|

4.1.3.211 InitializeConsole()

```
void mage::InitializeConsole ( )
```

Allocates a console to this engine for basic io and redirects stdin, stdout and stderr to the allocated console.

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to initialize the console. |
|---------------------------|-----------------------------------|

4.1.3.212 InvertHandness() [1/4]

```
const UV mage::InvertHandness (
    const UV & uv )
```

Inverts the handness of the given set of `UV` texture coordinates.

Parameters

| | | |
|----|----|---|
| in | uv | A reference to the set of UV texture coordinates. |
|----|----|---|

Returns

The set of UV texture coordinates with inverted hardness.

4.1.3.213 InvertHardness() [2/4]

```
const Point3 mage::InvertHardness (
    const Point3 & point )
```

Inverts the hardness of the given point.

Parameters

| | | |
|----|-------|---------------------------|
| in | point | A reference to the point. |
|----|-------|---------------------------|

Returns

The point with inverted hardness.

4.1.3.214 InvertHardness() [3/4]

```
const Direction3 mage::InvertHardness (
    const Direction3 & direction )
```

Inverts the hardness of the given direction.

Parameters

| | | |
|----|-----------|-------------------------------|
| in | direction | A reference to the direction. |
|----|-----------|-------------------------------|

Returns

The direction with inverted hardness.

4.1.3.215 InvertHardness() [4/4]

```
const Normal3 mage::InvertHardness (
    const Normal3 & normal )
```

Inverts the hardness of the given normal.

Parameters

| | | |
|----|---------------|----------------------------|
| in | <i>normal</i> | A reference to the normal. |
|----|---------------|----------------------------|

Returns

The normal with inverted handness.

4.1.3.216 LoadTextureDataFromFile()

```
static HRESULT mage::LoadTextureDataFromFile (
    _In_z_ const wchar_t * file_name,
    std::unique_ptr< uint8_t[] > & dds_data,
    DDS_HEADER ** header,
    uint8_t ** bit_data,
    size_t * bit_size ) [static]
```

4.1.3.217 MainWindowProc()

```
LRESULT CALLBACK mage::MainWindowProc (
    HWND hWnd,
    UINT msg,
    WPARAM wParam,
    LPARAM lParam )
```

The application-defined function that processes messages sent to the engine window. The WindowProc type defines a pointer to this callback function.

Parameters

| | | |
|----|---------------|--|
| in | <i>hWnd</i> | A handle to the window. |
| in | <i>msg</i> | The message. |
| in | <i>wParam</i> | Additional message information. The contents of this parameter depend on the value of <i>msg</i> . |
| in | <i>lParam</i> | Additional message information. The contents of this parameter depend on the value of <i>msg</i> . |

Returns

The return value is the result of the message processing and depends on the message sent.

4.1.3.218 MakeSRGB()

```
static DXGI_FORMAT mage::MakeSRGB (
    _In_ DXGI_FORMAT format ) [static]
```

4.1.3.219 NumberOfSystemCores()

```
size_t mage::NumberOfSystemCores ( )
```

Returns the number of system cores (i.e. logical processors).

Returns

The number of system cores (i.e. logical processors).

4.1.3.220 operator<<() [1/3]

```
ostream& mage::operator<< (
    ostream & os,
    const XMFLOAT2 & v )
```

Outputs the given vector to the given output stream.

Parameters

| | | |
|----|----|-----------------------------------|
| in | os | A reference to the output stream. |
| in | v | A reference to the vector. |

Returns

A reference to the given output stream.

4.1.3.221 operator<<() [2/3]

```
ostream& mage::operator<< (
    ostream & os,
    const XMFLOAT3 & v )
```

Outputs the given vector to the given output stream.

Parameters

| | | |
|----|----|-----------------------------------|
| in | os | A reference to the output stream. |
| in | v | A reference to the vector. |

Returns

A reference to the given output stream.

4.1.3.222 operator<<() [3/3]

```
ostream& mage::operator<< (
    ostream & os,
    const XMFLOAT4 & v )
```

Outputs the given vector to the given output stream.

Parameters

| | | |
|----|-----------|-----------------------------------|
| in | <i>os</i> | A reference to the output stream. |
| in | <i>v</i> | A reference to the vector. |

Returns

A reference to the given output stream.

4.1.3.223 Overlap()

```
const AABB mage::Overlap (
    const AABB & aabb1,
    const AABB & aabb2 )
```

Returns the overlap [AABB](#) of the two given AABBs.

Parameters

| | | |
|----|--------------|--|
| in | <i>aabb1</i> | A reference to the first AABB . |
| in | <i>aabb2</i> | A reference to the second AABB . |

Returns

The identity [AABB](#) in case of no overlap.
 The overlap [AABB](#) of *aabb1* and *aabb2*.

4.1.3.224 OverlapStrict()

```
const AABB mage::OverlapStrict (
    const AABB & aabb1,
    const AABB & aabb2 )
```

Returns the strict overlap [AABB](#) of the two given AABBs.

Parameters

| | | |
|----|--------------|--|
| in | <i>aabb1</i> | A reference to the first AABB . |
| in | <i>aabb2</i> | A reference to the second AABB . |

Returns

The identity [AABB](#) in case of no strict overlap.
 The strict overlap [AABB](#) of *aabb1* and *aabb2*.

4.1.3.225 PrintConsoleHeader()

```
void mage::PrintConsoleHeader ( )
```

Prints the header of the engine to the console.

4.1.3.226 ProcessError()

```
static void mage::ProcessError (
    const char * format,
    const va_list args,
    const string & error_type,
    ErrorDisposition disposition ) [static]
```

Process the given error.

Precondition

format is not equal to `nullptr`.

Parameters

| | | |
|----|--------------------|-------------------------------------|
| in | <i>format</i> | The format of the error string. |
| in | <i>args</i> | The arguments of the format string. |
| in | <i>error_type</i> | The type of the error. |
| in | <i>disposition</i> | The disposition of the error. |

4.1.3.227 ReadBinaryFile()

```
void mage::ReadBinaryFile (
    const wchar_t * fname,
    UniquePtr< uint8_t[] > & data,
    size_t * size )
```

Reads the bytes of a binary file.

Precondition

fname is not equal to `nullptr`.
size is not equal to `nullptr`.

Parameters

| | | |
|-----|--------------|---|
| in | <i>fname</i> | A pointer to a null-terminated wide string representing the filename. |
| out | <i>data</i> | A reference to a pointer to a buffer for storing the read bytes. |
| out | <i>size</i> | A pointer to the size of the read bytes. |

Exceptions

| | |
|---------------------------|-------------------------------------|
| <i>FormattedException</i> | Failed to read from the given file. |
|---------------------------|-------------------------------------|

4.1.3.228 ReadBool()

```
TokenResult mage::ReadBool (
    char * str,
    char ** context,
    bool & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a `bool` (`true` or `false`).

Precondition

`str` or `context` is not equal to `nullptr`.
`delimiters` is not equal to `nullptr`.

Parameters

| | | |
|---------|-------------------------|---|
| in | <code>str</code> | A pointer to the null-terminated byte string. If <code>str</code> is equal to <code>nullptr</code> , reading continues from the beginning of <code>str</code> . Otherwise, reading continues from the current position. |
| in, out | <code>context</code> | A pointer to the current position int he given string <code>str</code> . |
| out | <code>result</code> | A reference to the <code>bool</code> represented by the next token in the given string <code>str</code> . |
| in | <code>delimiters</code> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `bool` succeeded or not.

4.1.3.229 ReadChars()

```
TokenResult mage::ReadChars (
    char * str,
    char ** context,
    char ** result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to (non-delimiting) characters.

Precondition

`str` or `context` is not equal to `nullptr`.
`result` is not equal to `nullptr`.
`delimiters` is not equal to `nullptr`.

Parameters

| | | |
|----------------------|-------------------------|---|
| in | <code>str</code> | A pointer to the null-terminated byte string. If <code>str</code> is equal to <code>nullptr</code> , reading continues from the beginning of <code>str</code> . Otherwise, reading continues from the current position. |
| in, out | <code>context</code> | A pointer to the current position int he given string <code>str</code> . |
| out | <code>result</code> | A pointer to the pointer to the characters represented by the next token in the given string <code>str</code> . |
| Generated by Doxygen | <code>delimiters</code> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to characters succeeded or not.

4.1.3.230 ReadDouble()

```
TokenResult mage::ReadDouble (
    char * str,
    char ** context,
    double & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a double.

Precondition

str or *context* is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|---------|-------------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to <code>nullptr</code> , reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| in, out | <i>context</i> | A pointer to the current position int he given string <i>str</i> . |
| out | <i>result</i> | A reference to the double represented by the next token in the given string <i>str</i> . |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `double` succeeded or not.

4.1.3.231 ReadFloat()

```
TokenResult mage::ReadFloat (
    char * str,
    char ** context,
    float & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a `float`.

Precondition

str or *context* is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----------------|-------------------|---|
| <i>in</i> | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to <code>nullptr</code> , reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| <i>in, out</i> | <i>context</i> | A pointer to the current position int he given string <i>str</i> . |
| <i>out</i> | <i>result</i> | A reference to the <code>float</code> represented by the next token in the given string <i>str</i> . |
| <i>in</i> | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `float` succeeded or not.

4.1.3.232 ReadFloat2()

```
TokenResult mage::ReadFloat2 (
    char * str,
    char ** context,
    XMFLOAT2 & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a `XMFLOAT2`.

Precondition

str or *context* is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----------------|-------------------|---|
| <i>in</i> | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to <code>nullptr</code> , reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| <i>in, out</i> | <i>context</i> | A pointer to the current position int he given string <i>str</i> . |
| <i>out</i> | <i>result</i> | A reference to the <code>XMFLOAT2</code> represented by the next token in the given string <i>str</i> . |
| <i>in</i> | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `XMFLOAT2` succeeded or not.

4.1.3.233 ReadFloat3()

```
TokenResult mage::ReadFloat3 (
    char * str,
    char ** context,
```

```
XMFLOAT3 & result,
const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a XMFLOAT3.

Precondition

str or *context* is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|---------|-------------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to <code>nullptr</code> , reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| in, out | <i>context</i> | A pointer to the current position int he given string <i>str</i> . |
| out | <i>result</i> | A reference to the XMFLOAT3 represented by the next token in the given string <i>str</i> . |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a XMFLOAT3 succeeded or not.

4.1.3.234 ReadFloat4()

```
TokenResult mage::ReadFloat4 (
    char * str,
    char ** context,
    XMFLOAT4 & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a XMFLOAT4.

Precondition

str or *context* is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|---------|-------------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to <code>nullptr</code> , reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| in, out | <i>context</i> | A pointer to the current position int he given string <i>str</i> . |
| out | <i>result</i> | A reference to the XMFLOAT4 represented by the next token in the given string <i>str</i> . |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a XMFLOAT4 succeeded or not.

4.1.3.235 ReadInt16()

```
TokenResult mage::ReadInt16 (
    char * str,
    char ** context,
    int16_t & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a int16_t.

Precondition

str or *context* is not equal to nullptr.
delimiters is not equal to nullptr.

Parameters

| | | |
|---------|-------------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to nullptr, reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| in, out | <i>context</i> | A pointer to the current position in the given string <i>str</i> . |
| out | <i>result</i> | A reference to the int16_t represented by the next token in the given string <i>str</i> . |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a int16_t succeeded or not.

4.1.3.236 ReadInt32()

```
TokenResult mage::ReadInt32 (
    char * str,
    char ** context,
    int32_t & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a int32_t.

Precondition

str or *context* is not equal to nullptr.
delimiters is not equal to nullptr.

Parameters

| | | |
|----------------|-------------------|---|
| <i>in</i> | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to <code>nullptr</code> , reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| <i>in, out</i> | <i>context</i> | A pointer to the current position int he given string <i>str</i> . |
| <i>out</i> | <i>result</i> | A reference to the <code>int32_t</code> represented by the next token in the given string <i>str</i> . |
| <i>in</i> | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `int32_t` succeeded or not.

4.1.3.237 ReadInt64()

```
TokenResult mage::ReadInt64 (
    char * str,
    char ** context,
    int64_t & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a `int64_t`.

Precondition

str or *context* is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----------------|-------------------|---|
| <i>in</i> | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to <code>nullptr</code> , reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| <i>in, out</i> | <i>context</i> | A pointer to the current position int he given string <i>str</i> . |
| <i>out</i> | <i>result</i> | A reference to the <code>int64_t</code> represented by the next token in the given string <i>str</i> . |
| <i>in</i> | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `int64_t` succeeded or not.

4.1.3.238 ReadInt8()

```
TokenResult mage::ReadInt8 (
    char * str,
    char ** context,
```

```
int8_t & result,
const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a `int8_t`.

Precondition

`str` or `context` is not equal to `nullptr`.
`delimiters` is not equal to `nullptr`.

Parameters

| | | |
|---------|-------------------------|---|
| in | <code>str</code> | A pointer to the null-terminated byte string. If <code>str</code> is equal to <code>nullptr</code> , reading continues from the beginning of <code>str</code> . Otherwise, reading continues from the current position. |
| in, out | <code>context</code> | A pointer to the current position int he given string <code>str</code> . |
| out | <code>result</code> | A reference to the <code>int8_t</code> represented by the next token in the given string <code>str</code> . |
| in | <code>delimiters</code> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `int8_t` succeeded or not.

4.1.3.239 `ReadQuotedString()`

```
TokenResult mage::ReadQuotedString (
    char * str,
    char ** context,
    string & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a quoted string.

Precondition

`str` or `context` is not equal to `nullptr`.
`delimiters` is not equal to `nullptr`.
The quote `""` may not be delimiter.

Parameters

| | | |
|---------|-------------------------|---|
| in | <code>str</code> | A pointer to the null-terminated byte string. If <code>str</code> is equal to <code>nullptr</code> , reading continues from the beginning of <code>str</code> . Otherwise, reading continues from the current position. |
| in, out | <code>context</code> | A pointer to the current position int he given string <code>str</code> . |
| out | <code>result</code> | A reference to the quoted string represented by the next token in the given string <code>str</code> . |
| in | <code>delimiters</code> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a quoted string succeeded or not.

4.1.3.240 ReadString()

```
TokenResult mage::ReadString (
    char * str,
    char ** context,
    string & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a string.

Precondition

str or *context* is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|---------|-------------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to <code>nullptr</code> , reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| in, out | <i>context</i> | A pointer to the current position int he given string <i>str</i> . |
| out | <i>result</i> | A reference to the string represented by the next token in the given string <i>str</i> . |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a string succeeded or not.

4.1.3.241 ReadUInt16()

```
TokenResult mage::ReadUInt16 (
    char * str,
    char ** context,
    uint16_t & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a `uint16_t`.

Precondition

str or *context* is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----------------|-------------------|---|
| <i>in</i> | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to <code>nullptr</code> , reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| <i>in, out</i> | <i>context</i> | A pointer to the current position int he given string <i>str</i> . |
| <i>out</i> | <i>result</i> | A reference to the <code>uint16_t</code> represented by the next token in the given string <i>str</i> . |
| <i>in</i> | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `uint16_t` succeeded or not.

4.1.3.242 ReadUInt32()

```
TokenResult mage::ReadUInt32 (
    char * str,
    char ** context,
    uint32_t & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a `uint32_t`.

Precondition

str or *context* is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----------------|-------------------|---|
| <i>in</i> | <i>str</i> | A pointer to the null-terminated byte string. If <i>str</i> is equal to <code>nullptr</code> , reading continues from the beginning of <i>str</i> . Otherwise, reading continues from the current position. |
| <i>in, out</i> | <i>context</i> | A pointer to the current position int he given string <i>str</i> . |
| <i>out</i> | <i>result</i> | A reference to the <code>uint32_t</code> represented by the next token in the given string <i>str</i> . |
| <i>in</i> | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `uint32_t` succeeded or not.

4.1.3.243 ReadUInt64()

```
TokenResult mage::ReadUInt64 (
    char * str,
    char ** context,
```

```
    uint64_t & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a `uint64_t`.

Precondition

`str` or `context` is not equal to `nullptr`.
`delimiters` is not equal to `nullptr`.

Parameters

| | | |
|---------|-------------------------|---|
| in | <code>str</code> | A pointer to the null-terminated byte string. If <code>str</code> is equal to <code>nullptr</code> , reading continues from the beginning of <code>str</code> . Otherwise, reading continues from the current position. |
| in, out | <code>context</code> | A pointer to the current position int he given string <code>str</code> . |
| out | <code>result</code> | A reference to the <code>uint64_t</code> represented by the next token in the given string <code>str</code> . |
| in | <code>delimiters</code> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `uint64_t` succeeded or not.

4.1.3.244 ReadUInt8()

```
TokenResult mage::ReadUInt8 (
    char * str,
    char ** context,
    uint8_t & result,
    const char * delimiters = mage_default_delimiters )
```

Reads and converts the next token in the given string to a `uint8_t`.

Precondition

`str` or `context` is not equal to `nullptr`.
`delimiters` is not equal to `nullptr`.

Parameters

| | | |
|---------|-------------------------|---|
| in | <code>str</code> | A pointer to the null-terminated byte string. If <code>str</code> is equal to <code>nullptr</code> , reading continues from the beginning of <code>str</code> . Otherwise, reading continues from the current position. |
| in, out | <code>context</code> | A pointer to the current position int he given string <code>str</code> . |
| out | <code>result</code> | A reference to the <code>uint8_t</code> represented by the next token in the given string <code>str</code> . |
| in | <code>delimiters</code> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

A token result indicating whether the conversion of the next token in the given string to a `uint8_t` succeeded or not.

4.1.3.245 reinterpret_pointer_cast()

```
template<typename T , typename U >
UniquePtr< T > mage::reinterpret_pointer_cast (
    UniquePtr< U > && ptr )
```

Creates a unique pointer whose stored pointer is obtained by reinterpret casting the stored pointer of the given unique pointer.

Template Parameters

| | |
|----------|---------------------------|
| <i>T</i> | The conversion to-type. |
| <i>U</i> | The conversion from-type. |

Parameters

| | | |
|----|------------|-----------------------------|
| in | <i>ptr</i> | The unique pointer to move. |
|----|------------|-----------------------------|

Returns

The moved unique pointer.

4.1.3.246 RejectDisplayMode()

```
bool mage::RejectDisplayMode (
    const DXGI_MODE_DESC1 & display_mode_desc )
```

Checks whether the given display mode needs to be rejected for the engine.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>display_mode_desc</i> | A reference to a display mode descriptor. |
|----|--------------------------|---|

Returns

`true` if the given display mode needs to be rejected for the engine. `false` otherwise.

4.1.3.247 RemoveAndDestructAllElements()

```
template<typename ContainerT >
void mage::RemoveAndDestructAllElements (
    ContainerT & container )
```

Removes and destructs all the elements from the given container.

Template Parameters

| | |
|-------------------|------------------------|
| <i>ContainerT</i> | The type of container. |
|-------------------|------------------------|

Parameters

| | | |
|----|------------------|-------------------------------|
| in | <i>container</i> | A reference to the container. |
|----|------------------|-------------------------------|

4.1.3.248 RemoveAndDestructAllSecondElements()

```
template<typename ContainerT >
void mage::RemoveAndDestructAllSecondElements (
    ContainerT & container )
```

Removes and destructs all the second elements from the given container.

Template Parameters

| | |
|-------------------|------------------------|
| <i>ContainerT</i> | The type of container. |
|-------------------|------------------------|

Parameters

| | | |
|----|------------------|-------------------------------|
| in | <i>container</i> | A reference to the container. |
|----|------------------|-------------------------------|

4.1.3.249 Removelf()

```
template<typename ContainerT , typename PredicateT >
void mage::RemoveIf (
    ContainerT & container,
    const PredicateT & predicate )
```

Removes from the given container all the elements that compare equal to the given predicate. This reduces the container size by the number of elements removed.

Template Parameters

| | |
|-------------------|------------------------|
| <i>ContainerT</i> | The type of container. |
| <i>PredicateT</i> | The type of predicate. |

Parameters

| | | |
|----|------------------|-------------------------------|
| in | <i>container</i> | A reference to the container. |
| in | <i>predicate</i> | A reference to the predicate. |

4.1.3.250 SafeHandle()

```
HANDLE mage::SafeHandle (
    HANDLE handle )
```

Converts the given handle to a safe handle.

Parameters

| | | |
|----|---------------|-----------|
| in | <i>handle</i> | A handle. |
|----|---------------|-----------|

Returns

If the given handle is an invalid handle, `nullptr` is returned.
Otherwise, the given handle is returned.

4.1.3.251 SetDebugObjectName()

```
template<UINT TNameLength>
void mage::SetDebugObjectName (
    _In_ ID3D11DeviceChild * resource,
    _In_ const char(&) name[TNameLength] )
```

4.1.3.252 SettingsDialogProcDelegate()

```
INT_PTR CALLBACK mage::SettingsDialogProcDelegate (
    HWND hwndDlg,
    UINT uMsg,
    WPARAM wParam,
    LPARAM lParam )
```

Engine-defined callback function used with the `CreateDialog` for device enumeration.

Parameters

| | | |
|----|----------------|--|
| in | <i>hwndDlg</i> | A handle to the dialog box. |
| in | <i>uMsg</i> | The message. |
| in | <i>wParam</i> | Additional message-specific information. |
| in | <i>lParam</i> | Additional message-specific information. |

Returns

`true` if *uMsg* is processed. `false` otherwise.

4.1.3.253 SkipDelimiters() [1/2]

```
char * mage::SkipDelimiters (
    char * str,
    const char * delimiters = mage_default_delimiters )
```

Advances to the first non-delimiting character in the given string.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

`nullptr` if the end of string character is reached.
A pointer to the first non-delimiting character in the given string.

4.1.3.254 SkipDelimiters() [2/2]

```
const char * mage::SkipDelimiters (
    const char * str,
    const char * delimiters = mage_default_delimiters )
```

Advances to the first non-delimiting character in the given string.

Precondition

str is not equal to `nullptr`.
delimiters is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string. |
| in | <i>delimiters</i> | A pointer to the null-terminated byte string containing the delimiting characters. |

Returns

`nullptr` if the end of string character is reached.
A pointer to the first non-delimiting character in the given string.

4.1.3.255 static_pointer_cast()

```
template<typename T , typename U >
UniquePtr< T > mage::static_pointer_cast (
    UniquePtr< U > && ptr )
```

Creates a unique pointer whose stored pointer is obtained by statically casting the stored pointer of the given unique pointer.

Template Parameters

| | |
|----------|---------------------------|
| <i>T</i> | The conversion to-type. |
| <i>U</i> | The conversion from-type. |

Parameters

| | | |
|----|------------|-----------------------------|
| in | <i>ptr</i> | The unique pointer to move. |
|----|------------|-----------------------------|

Returns

The moved unique pointer.

4.1.3.256 str_contains() [1/4]

```
bool mage::str_contains (
    const char * str1,
    const char * str2 )
```

Checks whether the first given string contains the second given string.

Precondition

str1 is not equal to `nullptr`.
str2 is not equal to `nullptr`.

Parameters

| | | |
|----|-------------|--|
| in | <i>str1</i> | A pointer to the null-terminated byte string to be scanned. |
| in | <i>str2</i> | A pointer to the null-terminated byte string containing the sequence of characters to match. |

Returns

`true` if *str1* contains a substring *str2*. `false` otherwise.

4.1.3.257 str_contains() [2/4]

```
bool mage::str_contains (
    const wchar_t * str1,
    const wchar_t * str2 )
```

Checks whether the first given string contains the second given string.

Precondition

str1 is not equal to `nullptr`.
str2 is not equal to `nullptr`.

Parameters

| | | |
|----|-------------|--|
| in | <i>str1</i> | A pointer to the null-terminated wide string to be scanned. |
| in | <i>str2</i> | A pointer to the null-terminated wide string containing the sequence of characters to match. |

Returns

true if *str1* contains a substring *str2*. false otherwise.

4.1.3.258 str_contains() [3/4]

```
bool mage::str_contains (
    const char * str,
    char c )
```

Checks whether the first given string contains the given character.

Precondition

str is not equal to nullptr.

Parameters

| | | |
|----|------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string to be scanned. |
| in | <i>c</i> | The byte character to match. |

Returns

true if *str* contains a *c*. false otherwise.

4.1.3.259 str_contains() [4/4]

```
bool mage::str_contains (
    const wchar_t * str,
    wchar_t c )
```

Checks whether the first given string contains the given character.

Precondition

str is not equal to nullptr.

Parameters

| | | |
|----|------------|---|
| in | <i>str</i> | A pointer to the null-terminated wide string to be scanned. |
| in | <i>c</i> | The wide character to match. |

Returns

`true` if `str` contains a `c`. `false` otherwise.

4.1.3.260 str_convert() [1/4]

```
const wchar_t * mage::str_convert (
    const char * str )
```

Converts the given byte string to a wide string.

Precondition

`str` is not equal to `nullptr`.

Parameters

| | | |
|----|------------------|---|
| in | <code>str</code> | A pointer to the null-terminated byte string to copy. |
|----|------------------|---|

Returns

A pointer to the to the null-terminated wide string copy of the given null-terminated byte string.

4.1.3.261 str_convert() [2/4]

```
const char * mage::str_convert (
    const wchar_t * str )
```

Converts the given wide string to an byte string.

Precondition

`str` is not equal to `nullptr`.

Parameters

| | | |
|----|------------------|---|
| in | <code>str</code> | A pointer to the null-terminated wide string to copy. |
|----|------------------|---|

Returns

A pointer to the to the null-terminated byte string copy of the given null-terminated wide string.

4.1.3.262 str_convert() [3/4]

```
const wstring mage::str_convert (
    const string & str )
```

Converts the given byte string to a wide string.

Parameters

| | | |
|----|------------|---|
| in | <i>str</i> | A reference to the byte string to copy. |
|----|------------|---|

Returns

The wide string copy of the given byte string.

4.1.3.263 str_convert() [4/4]

```
const string mage::str_convert (
    const wstring & str )
```

Converts the given wide string to an byte string.

Parameters

| | | |
|----|------------|---|
| in | <i>str</i> | A reference to the wide string to copy. |
|----|------------|---|

Returns

The byte string copy of the given wide string.

4.1.3.264 str_equals() [1/2]

```
bool mage::str_equals (
    const char * str1,
    const char * str2 )
```

Checks whether the given strings are equal.

Precondition

str1 is not equal to nullptr.
str2 is not equal to nullptr.

Parameters

| | | |
|----|-------------|--|
| in | <i>str1</i> | A pointer to the first null-terminated byte string. |
| in | <i>str2</i> | A pointer to the second null-terminated byte string. |

Returns

true if *str1* is equal to *str2*. false otherwise.

4.1.3.265 str_equals() [2/2]

```
bool mage::str_equals (
    const wchar_t * str1,
    const wchar_t * str2 )
```

Checks whether the given strings are equal.

Precondition

str1 is not equal to `nullptr`.
str2 is not equal to `nullptr`.

Parameters

| | | |
|----|-------------|--|
| in | <i>str1</i> | A pointer to the first null-terminated wide string. |
| in | <i>str2</i> | A pointer to the second null-terminated wide string. |

Returns

`true` if *str1* is equal to *str2*. `false` otherwise.

4.1.3.266 str_escape_first() [1/4]

```
const char * mage::str_escape_first (
    const char * str,
    char c )
```

Finds the first occurrence of the given character in the given string neglecting the usage of the given character in a custom escape sequence.

Precondition

str is not equal to `nullptr`.

Parameters

| | | |
|----|------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string to be scanned. |
| in | <i>c</i> | The byte character to match. |

Returns

`nullptr` if *str* does not contain *c*.
A pointer to the first occurrence of *c* in *str*.

4.1.3.267 str_escape_first() [2/4]

```
char * mage::str_escape_first (
    char * str,
    char c )
```

Finds the first occurrence of the given character in the given string neglecting the usage of the given character in a custom escape sequence.

Precondition

str is not equal to `nullptr`.

Parameters

| | | |
|----|------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string to be scanned. |
| in | <i>c</i> | The byte character to match. |

Returns

`nullptr` if *str* does not contain *c*.
A pointer to the first occurrence of *c* in *str*.

4.1.3.268 `str_escape_first()` [3/4]

```
const wchar_t * mage::str_escape_first (
    const wchar_t * str,
    wchar_t c )
```

Finds the first occurrence of the given character in the given string neglecting the usage of the given character in a custom escape sequence.

Precondition

str is not equal to `nullptr`.

Parameters

| | | |
|----|------------|---|
| in | <i>str</i> | A pointer to the null-terminated wide string to be scanned. |
| in | <i>c</i> | The wide character to match. |

Returns

`nullptr` if *str* does not contain *c*.
A pointer to the first occurrence of *c* in *str*.

4.1.3.269 `str_escape_first()` [4/4]

```
wchar_t * mage::str_escape_first (
    wchar_t * str,
    wchar_t c )
```

Finds the first occurrence of the given character in the given string neglecting the usage of the given character in a custom escape sequence.

Precondition

str is not equal to `nullptr`.

Parameters

| | | |
|----|------------|---|
| in | <i>str</i> | A pointer to the null-terminated wide string to be scanned. |
| in | <i>c</i> | The wide character to match. |

Returns

`nullptr` if *str* does not contain *c*.
A pointer to the first occurrence of *c* in *str*.

4.1.3.270 str_gets() [1/2]

```
char * mage::str_gets (
    char * str,
    int num,
    const char ** input )
```

Reads characters from the given input string and stores them as a C string into *str* until (*num*-1) characters have been read or either a newline or the end-of-file is reached, whichever happens first.

A newline character makes `sgets` stop reading, but it is considered a valid character by the function and included in the string copied to *str*.

A terminating null character is automatically appended after the characters copied to *str*.

Precondition

str is not equal to `nullptr`.
input is not equal to `nullptr`.

Parameters

| | | |
|----|--------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string to copy to. |
| in | <i>num</i> | Maximum number of characters to be copied into <i>str</i> (including the terminating null-character). |
| in | <i>input</i> | A pointer to a pointer to the input string. |

Note

The `sgets` function is the byte string variant of `fgets`.

4.1.3.271 str_gets() [2/2]

```
wchar_t * mage::str_gets (
    wchar_t * str,
```

```
int num,
const wchar_t ** input )
```

Reads characters from the given input string and stores them as a C string into *str* until (num-1) characters have been read or either a newline or the end-of-file is reached, whichever happens first.

A newline character makes `sgets` stop reading, but it is considered a valid character by the function and included in the string copied to *str*.

A terminating null character is automatically appended after the characters copied to *str*.

Precondition

str is not equal to `nullptr`.
input is not equal to `nullptr`.

Parameters

| | | |
|----|--------------|---|
| in | <i>str</i> | A pointer to the null-terminated wide string to copy to. |
| in | <i>num</i> | Maximum number of characters to be copied into <i>str</i> (including the terminating null-character). |
| in | <i>input</i> | A pointer to a pointer to the input string. |

Note

The `sgets` function is the wide string variant of `fgets`.

4.1.3.272 StringPrefix.ToDouble()

```
TokenResult mage::StringPrefix.ToDouble (
    const char * str,
    double & result )
```

Converts the prefix of the given string *str* to a double.

Parameters

| | | |
|-----|---------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the double represented by the prefix of the given string <i>str</i> . |

Returns

A token result indicating whether the conversion of the prefix of the given string *str* to a double succeeded or not.

4.1.3.273 StringPrefix.ToFloat()

```
TokenResult mage::StringPrefix.ToFloat (
    const char * str,
    float & result )
```

Converts the prefix of the given string *str* to a float.

Parameters

| | | |
|------------|----------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>float</code> represented by the prefix of the given string <i>str</i> . |

Returns

A token result indicating whether the conversion of the prefix of the given string *str* to a `float` succeeded or not.

4.1.3.274 StringPrefixToInt16()

```
TokenResult mage::StringPrefixToInt16 (
    const char * str,
    int16_t & result )
```

Converts the prefix of the given string *str* to a `int16_t`.

Parameters

| | | |
|------------|----------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>int16_t</code> represented by the prefix of the given string <i>str</i> . |

Returns

A token result indicating whether the conversion of the prefix of the given string *str* to a `int16_t` succeeded or not.

4.1.3.275 StringPrefixToInt32()

```
TokenResult mage::StringPrefixToInt32 (
    const char * str,
    int32_t & result )
```

Converts the prefix of the given string *str* to a `int32_t`.

Parameters

| | | |
|------------|----------------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>int32_t</code> represented by the prefix of the given string <i>str</i> . |

Returns

A token result indicating whether the conversion of the prefix of the given string *str* to a `int32_t` succeeded or not.

4.1.3.276 StringPrefixToInt64()

```
TokenResult mage::StringPrefixToInt64 (
    const char * str,
    int64_t & result )
```

Converts the prefix of the given string *str* to a `int64_t`.

Parameters

| | | |
|------------------|---------------|--|
| <code>in</code> | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| <code>out</code> | <i>result</i> | A reference to the <code>int64_t</code> represented by the prefix of the given string <i>str</i> . |

Returns

A token result indicating whether the conversion of the prefix of the given string *str* to a `int64_t` succeeded or not.

4.1.3.277 StringPrefixToInt8()

```
TokenResult mage::StringPrefixToInt8 (
    const char * str,
    int8_t & result )
```

Converts the prefix of the given string *str* to a `int8_t`.

Parameters

| | | |
|------------------|---------------|---|
| <code>in</code> | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| <code>out</code> | <i>result</i> | A reference to the <code>int8_t</code> represented by the prefix of the given string <i>str</i> . |

Returns

A token result indicating whether the conversion of the prefix of the given string *str* to a `int8_t` succeeded or not.

4.1.3.278 StringPrefixToUInt16()

```
TokenResult mage::StringPrefixToUInt16 (
    const char * str,
    uint16_t & result )
```

Converts the prefix of the given string *str* to a `uint16_t`.

Parameters

| | | |
|------------------|---------------|---|
| <code>in</code> | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| <code>out</code> | <i>result</i> | A reference to the <code>uint16_t</code> represented by the prefix of the given string <i>str</i> . |

Returns

A token result indicating whether the conversion of the prefix of the given string *str* to a `uint16_t` succeeded or not.

4.1.3.279 StringPrefixToUInt32()

```
TokenResult mage::StringPrefixToUInt32 (
    const char * str,
    uint32_t & result )
```

Converts the prefix of the given string *str* to a `uint32_t`.

Parameters

| | | |
|------------------|---------------------|---|
| <code>in</code> | <code>str</code> | A pointer to the null-terminated byte string to convert. |
| <code>out</code> | <code>result</code> | A reference to the <code>uint32_t</code> represented by the prefix of the given string <i>str</i> . |

Returns

A token result indicating whether the conversion of the prefix of the given string *str* to a `uint32_t` succeeded or not.

4.1.3.280 StringPrefixToUInt64()

```
TokenResult mage::StringPrefixToUInt64 (
    const char * str,
    uint64_t & result )
```

Converts the prefix of the given string *str* to a `uint64_t`.

Parameters

| | | |
|------------------|---------------------|---|
| <code>in</code> | <code>str</code> | A pointer to the null-terminated byte string to convert. |
| <code>out</code> | <code>result</code> | A reference to the <code>uint64_t</code> represented by the prefix of the given string <i>str</i> . |

Returns

A token result indicating whether the conversion of the prefix of the given string *str* to a `uint64_t` succeeded or not.

4.1.3.281 StringPrefixToInt8()

```
TokenResult mage::StringPrefixToInt8 (
    const char * str,
    int8_t & result )
```

Converts the prefix of the given string *str* to a `int8_t`.

Parameters

| | | |
|-----|---------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>uint8_t</code> represented by the prefix of the given string <i>str</i> . |

Returns

A token result indicating whether the conversion of the prefix of the given string *str* to a `uint8_t` succeeded or not.

4.1.3.282 StringToBool() [1/2]

```
TokenResult mage::StringToBool (
    const char * str,
    bool & result )
```

Converts the given string to a `bool` (true or false).

Parameters

| | | |
|-----|---------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>bool</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `bool` succeeded or not.

4.1.3.283 StringToBool() [2/2]

```
TokenResult mage::StringToBool (
    const char * begin,
    const char * end,
    bool & result )
```

Converts the given string to a `bool` (true or false).

Precondition

end is not equal to `nullptr` if *begin* is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------|---|
| in | <i>begin</i> | A pointer to the begin (inclusive) of the string to convert. |
| in | <i>end</i> | A pointer to the end (exclusive) of the string to convert. |
| out | <i>result</i> | A reference to the <code>bool</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `bool` succeeded or not.

4.1.3.284 StringToDouble() [1/2]

```
TokenResult mage::StringToDouble (
    const char * str,
    double & result )
```

Converts the given string to a `double`.

Parameters

| | | |
|-----|---------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>double</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `double` succeeded or not.

4.1.3.285 StringToDouble() [2/2]

```
TokenResult mage::StringToDouble (
    const char * begin,
    const char * end,
    double & result )
```

Converts the given string to a `double`.

Precondition

end is not equal to `nullptr` if *begin* is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------|---|
| in | <i>begin</i> | A pointer to the begin (inclusive) of the string to convert. |
| in | <i>end</i> | A pointer to the end (exclusive) of the string to convert. |
| out | <i>result</i> | A reference to the <code>double</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `double` succeeded or not.

4.1.3.286 StringToFloat() [1/2]

```
TokenResult mage::StringToFloat (
    const char * str,
    float & result )
```

Converts the given string to a `float`.

Parameters

| | | |
|-----|---------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>float</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `float` succeeded or not.

4.1.3.287 `StringToFloat()` [2/2]

```
TokenResult mage::StringToFloat (
    const char * begin,
    const char * end,
    float & result )
```

Converts the given string to a `float`.

Precondition

end is not equal to `nullptr` if *begin* is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------|--|
| in | <i>begin</i> | A pointer to the begin (inclusive) of the string to convert. |
| in | <i>end</i> | A pointer to the end (exclusive) of the string to convert. |
| out | <i>result</i> | A reference to the <code>float</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `float` succeeded or not.

4.1.3.288 `StringToInt16()` [1/2]

```
TokenResult mage::StringToInt16 (
    const char * str,
    int16_t & result )
```

Converts the given string to a `int16_t`.

Parameters

| | | |
|-----|---------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>int16_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `int16_t` succeeded or not.

4.1.3.289 StringToInt16() [2/2]

```
TokenResult mage::StringToInt16 (
    const char * begin,
    const char * end,
    int16_t & result )
```

Converts the given string to a `int16_t`.

Precondition

end is not equal to `nullptr` if *begin* is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------|--|
| in | <i>begin</i> | A pointer to the begin (inclusive) of the string to convert. |
| in | <i>end</i> | A pointer to the end (exclusive) of the string to convert. |
| out | <i>result</i> | A reference to the <code>int16_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `int16_t` succeeded or not.

4.1.3.290 StringToInt32() [1/2]

```
TokenResult mage::StringToInt32 (
    const char * str,
    int32_t & result )
```

Converts the given string to a `int32_t`.

Parameters

| | | |
|-----|---------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>int32_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `int32_t` succeeded or not.

4.1.3.291 StringToInt32() [2/2]

```
TokenResult mage::StringToInt32 (
    const char * begin,
```

```
    const char * end,
    int32_t & result )
```

Converts the given string to a `int32_t`.

Precondition

`end` is not equal to `nullptr` if `begin` is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------------|--|
| in | <code>begin</code> | A pointer to the begin (inclusive) of the string to convert. |
| in | <code>end</code> | A pointer to the end (exclusive) of the string to convert. |
| out | <code>result</code> | A reference to the <code>int32_t</code> represented by the string <code>str</code> . |

Returns

A token result indicating whether the conversion of the given string `str` to a `int32_t` succeeded or not.

4.1.3.292 `StringToInt64()` [1/2]

```
TokenResult mage::StringToInt64 (
    const char * str,
    int64_t & result )
```

Converts the given string to a `int64_t`.

Parameters

| | | |
|-----|---------------------|--|
| in | <code>str</code> | A pointer to the null-terminated byte string to convert. |
| out | <code>result</code> | A reference to the <code>int64_t</code> represented by the string <code>str</code> . |

Returns

A token result indicating whether the conversion of the given string `str` to a `int64_t` succeeded or not.

4.1.3.293 `StringToInt64()` [2/2]

```
TokenResult mage::StringToInt64 (
    const char * begin,
    const char * end,
    int64_t & result )
```

Converts the given string to a `int64_t`.

Precondition

`end` is not equal to `nullptr` if `begin` is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------|--|
| in | <i>begin</i> | A pointer to the begin (inclusive) of the string to convert. |
| in | <i>end</i> | A pointer to the end (exclusive) of the string to convert. |
| out | <i>result</i> | A reference to the <code>int64_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `int64_t` succeeded or not.

4.1.3.294 StringToInt8() [1/2]

```
TokenResult mage::StringToInt8 (
    const char * str,
    int8_t & result )
```

Converts the given string to a `int8_t`.

Parameters

| | | |
|-----|---------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>int8_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `int8_t` succeeded or not.

4.1.3.295 StringToInt8() [2/2]

```
TokenResult mage::StringToInt8 (
    const char * begin,
    const char * end,
    int8_t & result )
```

Converts the given string to a `int8_t`.

Precondition

end is not equal to `nullptr` if *begin* is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------|---|
| in | <i>begin</i> | A pointer to the begin (inclusive) of the string to convert. |
| in | <i>end</i> | A pointer to the end (exclusive) of the string to convert. |
| out | <i>result</i> | A reference to the <code>int8_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `int8_t` succeeded or not.

4.1.3.296 StringToInt16() [1/2]

```
TokenResult mage::StringToInt16 (
    const char * str,
    uint16_t & result )
```

Converts the given string to a `uint16_t`.

Parameters

| | | |
|------------------|---------------------|---|
| <code>in</code> | <code>str</code> | A pointer to the null-terminated byte string to convert. |
| <code>out</code> | <code>result</code> | A reference to the <code>uint16_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `uint16_t` succeeded or not.

4.1.3.297 StringToInt16() [2/2]

```
TokenResult mage::StringToInt16 (
    const char * begin,
    const char * end,
    uint16_t & result )
```

Converts the given string to a `uint16_t`.

Precondition

end is not equal to `nullptr` if *begin* is not equal to `nullptr`.

Parameters

| | | |
|------------------|---------------------|---|
| <code>in</code> | <code>begin</code> | A pointer to the begin (inclusive) of the string to convert. |
| <code>in</code> | <code>end</code> | A pointer to the end (exclusive) of the string to convert. |
| <code>out</code> | <code>result</code> | A reference to the <code>uint16_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `uint16_t` succeeded or not.

4.1.3.298 StringToInt32() [1/2]

```
TokenResult mage::StringToInt32 (
    const char * str,
    uint32_t & result )
```

Converts the given string to a `uint32_t`.

Parameters

| | | |
|-----|---------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>uint32_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `uint32_t` succeeded or not.

4.1.3.299 `StringToInt32()` [2/2]

```
TokenResult mage::StringToInt32 (
    const char * begin,
    const char * end,
    uint32_t & result )
```

Converts the given string to a `uint32_t`.

Precondition

end is not equal to `nullptr` if *begin* is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------|---|
| in | <i>begin</i> | A pointer to the begin (inclusive) of the string to convert. |
| in | <i>end</i> | A pointer to the end (exclusive) of the string to convert. |
| out | <i>result</i> | A reference to the <code>uint32_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `uint32_t` succeeded or not.

4.1.3.300 `StringToInt64()` [1/2]

```
TokenResult mage::StringToInt64 (
    const char * str,
    uint64_t & result )
```

Converts the given string to a `uint64_t`.

Parameters

| | | |
|-----|---------------|---|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>uint64_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `uint64_t` succeeded or not.

4.1.3.301 StringToInt64() [2/2]

```
TokenResult mage::StringToInt64 (
    const char * begin,
    const char * end,
    uint64_t & result )
```

Converts the given string to a `uint64_t`.

Precondition

end is not equal to `nullptr` if *begin* is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------|---|
| in | <i>begin</i> | A pointer to the begin (inclusive) of the string to convert. |
| in | <i>end</i> | A pointer to the end (exclusive) of the string to convert. |
| out | <i>result</i> | A reference to the <code>uint64_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `uint64_t` succeeded or not.

4.1.3.302 StringToInt8() [1/2]

```
TokenResult mage::StringToInt8 (
    const char * str,
    uint8_t & result )
```

Converts the given string to a `uint8_t`.

Parameters

| | | |
|-----|---------------|--|
| in | <i>str</i> | A pointer to the null-terminated byte string to convert. |
| out | <i>result</i> | A reference to the <code>uint8_t</code> represented by the string <i>str</i> . |

Returns

A token result indicating whether the conversion of the given string *str* to a `uint8_t` succeeded or not.

4.1.3.303 StringToInt8() [2/2]

```
TokenResult mage::StringToInt8 (
    const char * begin,
```

```
    const char * end,
    uint8_t & result )
```

Converts the given string to a `uint8_t`.

Precondition

`end` is not equal to `nullptr` if `begin` is not equal to `nullptr`.

Parameters

| | | |
|-----|---------------------|--|
| in | <code>begin</code> | A pointer to the begin (inclusive) of the string to convert. |
| in | <code>end</code> | A pointer to the end (exclusive) of the string to convert. |
| out | <code>result</code> | A reference to the <code>uint8_t</code> represented by the string <code>str</code> . |

Returns

A token result indicating whether the conversion of the given string `str` to a `uint8_t` succeeded or not.

4.1.3.304 Union() [1/3]

```
template<typename VertexT >
const AABB mage::Union (
    const AABB & aabb,
    const VertexT & vertex )
```

Returns the union `AABB` of the given `AABB` and the given vertex.

Template Parameters

| | |
|----------------------|------------------|
| <code>VertexT</code> | The vertex type. |
|----------------------|------------------|

Parameters

| | | |
|----|---------------------|---|
| in | <code>aabb</code> | A reference to the <code>AABB</code> . |
| in | <code>vertex</code> | A reference to the <code>VertexT</code> . |

Returns

The union `AABB` of `aabb` and `vertex`.

4.1.3.305 Union() [2/3]

```
const AABB mage::Union (
    const AABB & aabb,
    const Point3 & point )
```

Returns the union `AABB` of the given `AABB` and the given point.

Parameters

| | | |
|----|--------------|---|
| in | <i>aabb</i> | A reference to the AABB . |
| in | <i>point</i> | A reference to the point. |

Returns

The union [AABB](#) of *aabb* and *point*.

4.1.3.306 Union() [3/3]

```
const AABB mage::Union (
    const AABB & aabb1,
    const AABB & aabb2 )
```

Returns the union [AABB](#) of the two given AABBs.

Parameters

| | | |
|----|--------------|--|
| in | <i>aabb1</i> | A reference to the first AABB . |
| in | <i>aabb2</i> | A reference to the second AABB . |

Returns

The union [AABB](#) of *aabb1* and *aabb2*.

4.1.3.307 Warning()

```
void mage::Warning (
    const char * format,
    ...
)
```

Notifies a warning message.

A warning message is associated with anything that can potentially cause application oddities.

Precondition

format is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|--------------------------------|
| in | <i>format</i> | Pointer to the message format. |
|----|---------------|--------------------------------|

4.1.3.308 XMVectorLeftTopRightBottom()

```
const XMVECTOR mage::XMVectorLeftTopRightBottom (
```

```
const RECT & rect )
```

Converts the given RECT (left, top, right, bottom) to a XMVECTOR (left, top, right, bottom).

Parameters

| | | |
|----|------|-------------------------------|
| in | rect | A reference to the rectangle. |
|----|------|-------------------------------|

Returns

A XMVECTOR (left, top, right, bottom) representing the given RECT (left, top, right, bottom).

4.1.3.309 XMVectorLeftTopWidthHeight()

```
const XMVECTOR mage::XMVectorLeftTopWidthHeight (
    const RECT & rect )
```

Converts the given RECT (left, top, right, bottom) to a XMVECTOR (left, top, width, height).

Parameters

| | | |
|----|------|-------------------------------|
| in | rect | A reference to the rectangle. |
|----|------|-------------------------------|

Returns

A XMVECTOR (left, top, width, height) representing the given RECT (left, top, right, bottom).

4.1.4 Variable Documentation

4.1.4.1 DDS_MAGIC

```
const uint32_t mage::DDS_MAGIC = 0x20534444
```

4.1.4.2 g_device_enumeration

```
DeviceEnumeration * mage::g_device_enumeration = nullptr
```

A (global) pointer to the device enumeration.

4.1.4.3 g_engine

```
Engine * mage::g_engine = nullptr
```

A pointer to the engine used by the user.

4.1.4.4 g_feature_levels

```
const D3D_FEATURE_LEVEL mage::g_feature_levels[ ]
```

Initial value:

```
= {
    D3D_FEATURE_LEVEL_11_1,
    D3D_FEATURE_LEVEL_11_0
}
```

The supported feature levels.

4.1.4.5 g_logging_configuration

```
LoggingConfiguration mage::g_logging_configuration
```

The logging configuration defined by the user and used by the engine.

4.1.4.6 g_pixel_formats

```
const DXGI_FORMAT mage::g_pixel_formats[ ]
```

Initial value:

```
= {
    DXGI_FORMAT_B5G5R5A1_UNORM,
    DXGI_FORMAT_B5G6R5_UNORM,
    DXGI_FORMAT_B8G8R8X8_UNORM,
    DXGI_FORMAT_B8G8R8A8_UNORM,
    DXGI_FORMAT_R10G10B10A2_UNORM,
}
```

The allowed pixel formats.

4.1.4.7 mage_default_delimiters

```
const char* const mage::mage_default_delimiters = "\t\n\r"
```

A pointer to the null-terminated byte string containing the default delimiters:

1. space character;
2. tab character;
3. end of line (EOL) character;
4. carriage return (CR) character.

Chapter 5

Class Documentation

5.1 mage::AABB Struct Reference

```
#include <bounding_volume.hpp>
```

Public Member Functions

- `AABB ()`
- `AABB (const Point3 &p)`
- `AABB (const Point3 &p_min, const Point3 &p_max)`
- `AABB (const AABB &aabb)=default`
- `AABB (AABB &&aabb)=default`
- `AABB (const BS &bs)`
- `~AABB ()=default`
- `AABB & operator= (const AABB &aabb)=default`
- `AABB & operator= (AABB &&aabb)=default`
- `bool Encloses (const Point3 &point) const`
- `bool EnclosesStrict (const Point3 &point) const`
- `bool Encloses (const AABB &aabb) const`
- `bool EnclosesStrict (const AABB &aabb) const`
- `bool Encloses (const BS &bs) const`
- `bool EnclosesStrict (const BS &bs) const`
- `bool EnclosedBy (const XMFLOAT4 *planes, size_t nb_planes) const`
- `bool EnclosedStrictBy (const XMFLOAT4 *planes, size_t nb_planes) const`
- `bool Overlaps (const AABB &aabb) const`
- `bool OverlapsStrict (const AABB &aabb) const`
- `const Point3 Centroid () const`
- `const Direction3 Diagonal () const`

Public Attributes

- `Point3 m_p_min`
- `Point3 m_p_max`

5.1.1 Detailed Description

A struct of Axis-Aligned Bounding Boxes (AABBs).

5.1.2 Constructor & Destructor Documentation

5.1.2.1 `AABB()` [1/6]

```
mage::AABB::AABB ( )
```

Constructs an (identity) [AABB](#).

5.1.2.2 `AABB()` [2/6]

```
mage::AABB::AABB (
    const Point3 & p ) [explicit]
```

Constructs an [AABB](#) of the given point.

Parameters

| | | |
|----|----------|---------------------------|
| in | <i>p</i> | A reference to the point. |
|----|----------|---------------------------|

5.1.2.3 `AABB()` [3/6]

```
mage::AABB::AABB (
    const Point3 & p_min,
    const Point3 & p_max ) [explicit]
```

Constructs an [AABB](#) of the given extents.

Precondition

p_min is entrywise smaller or equal to *p_max*.

Parameters

| | | |
|----|--------------|-------------------------------------|
| in | <i>p_min</i> | A reference to the minimum extents. |
| in | <i>p_max</i> | A reference to the maximum extents. |

5.1.2.4 `AABB()` [4/6]

```
mage::AABB::AABB (
    const AABB & aabb ) [default]
```

Constructs an [AABB](#) from the given [AABB](#).

Parameters

| | | |
|----|------|--|
| in | aabb | A reference to the AABB to copy. |
|----|------|--|

5.1.2.5 [AABB\(\)](#) [5/6]

```
mage::AABB::AABB (
    AABB && aabb ) [default]
```

Constructs an [AABB](#) by moving the given [AABB](#).

Parameters

| | | |
|----|------|--|
| in | aabb | A reference to the AABB to move. |
|----|------|--|

5.1.2.6 [AABB\(\)](#) [6/6]

```
mage::AABB::AABB (
    const BS & bs ) [explicit]
```

Constructs an [AABB](#) of the given [BS](#).

Parameters

| | | |
|----|----|---|
| in | bs | A reference to the BS . |
|----|----|---|

5.1.2.7 [~AABB\(\)](#)

```
mage::AABB::~AABB ( ) [default]
```

Destructs this [AABB](#).

5.1.3 Member Function Documentation**5.1.3.1 [Centroid\(\)](#)**

```
const Point3 mage::AABB::Centroid ( ) const
```

Returns the centroid of this [AABB](#).

Returns

The centroid of this [AABB](#).

5.1.3.2 Diagonal()

```
const Direction3 mage::AABB::Diagonal ( ) const
```

Returns the diagonal of this [AABB](#).

Returns

The diagonal of this [AABB](#).

5.1.3.3 EnclosedBy()

```
bool mage::AABB::EnclosedBy (
    const XMFLOAT4 * planes,
    size_t nb_planes ) const
```

Checks whether this [AABB](#) is completely enclosed by the given (closed) volume.

Precondition

planes is not equal to `nullptr`.
planes must point to an array of at least `nb_planes` *planes*.

Parameters

| | | |
|----|------------------|--|
| in | <i>planes</i> | A pointer to the planes of the volume. (each plane's coefficients are represented as a XMFLOAT4) |
| in | <i>nb_planes</i> | The number of planes. |

Returns

`true` if this [AABB](#) is completely enclosed by *planes*. `false` otherwise.

5.1.3.4 EnclosedStrictBy()

```
bool mage::AABB::EnclosedStrictBy (
    const XMFLOAT4 * planes,
    size_t nb_planes ) const
```

Checks whether this [AABB](#) is completely, strictly enclosed by the given (closed) volume.

Precondition

planes is not equal to `nullptr`.
planes must point to an array of at least `nb_planes` *planes*.

Parameters

| | | |
|----|------------------|--|
| in | <i>planes</i> | A pointer to the planes of the volume. (each plane's coefficients are represented as a XMFLOAT4) |
| in | <i>nb_planes</i> | The number of planes. |

Returns

true if this [AABB](#) is completely, strictly enclosed by *planes*. false otherwise.

5.1.3.5 Encloses() [1/3]

```
bool mage::AABB::Encloses (
    const Point3 & point ) const
```

Checks whether this [AABB](#) completely encloses the given point.

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>point</i> | A reference to the point. |
|----|--------------|---------------------------|

Returns

true if this [AABB](#) completely encloses *point*. false otherwise.

5.1.3.6 Encloses() [2/3]

```
bool mage::AABB::Encloses (
    const AABB & aabb ) const
```

Checks whether this [AABB](#) completely encloses the given [AABB](#).

Parameters

| | | |
|----|-------------|---|
| in | <i>aabb</i> | A reference to the AABB . |
|----|-------------|---|

Returns

true if this [AABB](#) completely encloses *aabb*. false otherwise.

5.1.3.7 Encloses() [3/3]

```
bool mage::AABB::Encloses (
    const BS & bs ) const
```

Checks whether this [AABB](#) completely encloses the given [BS](#).

Parameters

| | | |
|----|-----------|---|
| in | <i>bs</i> | A reference to the BS . |
|----|-----------|---|

Returns

true if this [AABB](#) completely encloses *bs*. false otherwise.

5.1.3.8 EnclosesStrict() [1/3]

```
bool mage::AABB::EnclosesStrict (
    const Point3 & point ) const
```

Checks whether this [AABB](#) completely, strictly encloses the given point.

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>point</i> | A reference to the point. |
|----|--------------|---------------------------|

Returns

true if this [AABB](#) completely, strictly encloses *point*. false otherwise.

5.1.3.9 EnclosesStrict() [2/3]

```
bool mage::AABB::EnclosesStrict (
    const AABB & aabb ) const
```

Checks whether this [AABB](#) completely, strictly encloses the given [AABB](#).

Parameters

| | | |
|----|-------------|---|
| in | <i>aabb</i> | A reference to the AABB . |
|----|-------------|---|

Returns

true if this [AABB](#) completely, strictly encloses *aabb*. false otherwise.

5.1.3.10 EnclosesStrict() [3/3]

```
bool mage::AABB::EnclosesStrict (
    const BS & bs ) const
```

Checks whether this [AABB](#) completely, strictly encloses the given [BS](#).

Parameters

| | | |
|----|-----------|---|
| in | <i>bs</i> | A reference to the BS . |
|----|-----------|---|

Returns

true if this [AABB](#) completely, strictly encloses *bs*. false otherwise.

5.1.3.11 operator=() [1/2]

```
AABB& mage::AABB::operator= (
    const AABB & aabb ) [default]
```

Copies the given [AABB](#) to this [AABB](#).

Parameters

| | | |
|----|-------------|--|
| in | <i>aabb</i> | A reference to the AABB to copy. |
|----|-------------|--|

Returns

A reference to the copy of the given [AABB](#) (i.e. this [AABB](#)).

5.1.3.12 operator=() [2/2]

```
AABB& mage::AABB::operator= (
    AABB && aabb ) [default]
```

Moves the given [AABB](#) to this [AABB](#).

Parameters

| | | |
|----|-------------|--|
| in | <i>aabb</i> | A reference to the AABB to move. |
|----|-------------|--|

Returns

A reference to the moved [AABB](#) (i.e. this [AABB](#)).

5.1.3.13 Overlaps()

```
bool mage::AABB::Overlaps (
    const AABB & aabb ) const
```

Checks whether this [AABB](#) overlaps the given [AABB](#).

Parameters

| | | |
|----|-------------------|---|
| in | <code>aabb</code> | A reference to the AABB . |
|----|-------------------|---|

Returns

true if this [AABB](#) overlaps `aabb`. false otherwise.

5.1.3.14 OverlapsStrict()

```
bool mage::AABB::OverlapsStrict (
    const AABB & aabb ) const
```

Checks whether this [AABB](#) strictly overlaps the given [AABB](#).

Parameters

| | | |
|----|-------------------|---|
| in | <code>aabb</code> | A reference to the AABB . |
|----|-------------------|---|

Returns

true if this [AABB](#) strictly overlaps `aabb`. false otherwise.

5.1.4 Member Data Documentation**5.1.4.1 m_p_max**

`Point3` `mage::AABB::m_p_max`

The maximum extents of this [AABB](#).

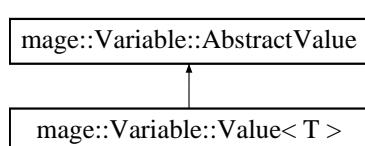
5.1.4.2 m_p_min

`Point3` `mage::AABB::m_p_min`

The minimum extents of this [AABB](#).

5.2 mage::Variable::AbstractValue Struct Reference

Inheritance diagram for `mage::Variable::AbstractValue`:



Public Member Functions

- virtual `~AbstractValue ()=default`
- `AbstractValue & operator= (const AbstractValue &abstract_value)=delete`
- `AbstractValue & operator= (AbstractValue &&abstract_value)=delete`
- virtual `AbstractValue * Clone () const =0`
- virtual const void * `GetValue () const =0`

Protected Member Functions

- `AbstractValue ()=default`
- `AbstractValue (const AbstractValue &abstract_value)=default`
- `AbstractValue (AbstractValue &&abstract_value)=default`

5.2.1 Detailed Description

A struct of immutable abstract values.

Note

This is an example of the Type Erasure pattern for templates. We need to keep the original type to ensure the right destructor can be called.

5.2.2 Constructor & Destructor Documentation

5.2.2.1 `~AbstractValue()`

```
virtual mage::Variable::AbstractValue::~AbstractValue ( ) [virtual], [default]
```

Destructs this value.

5.2.2.2 `AbstractValue()` [1/3]

```
mage::Variable::AbstractValue::AbstractValue ( ) [protected], [default]
```

Constructs an abstract value.

5.2.2.3 `AbstractValue()` [2/3]

```
mage::Variable::AbstractValue::AbstractValue (
    const AbstractValue & abstract_value ) [protected], [default]
```

Constructs an abstract value from the given abstract value.

Parameters

| | | |
|----|-----------------------------|--|
| in | <code>abstract_value</code> | A reference to the abstract value to copy. |
|----|-----------------------------|--|

5.2.2.4 AbstractValue() [3/3]

```
mage::Variable::AbstractValue::AbstractValue (
    AbstractValue && abstract_value ) [protected], [default]
```

Constructs an abstract value by moving the given abstract value.

Parameters

| | | |
|----|-----------------------|--|
| in | <i>abstract_value</i> | A reference to the abstract value to move. |
|----|-----------------------|--|

5.2.3 Member Function Documentation

5.2.3.1 Clone()

```
virtual AbstractValue* mage::Variable::AbstractValue::Clone ( ) const [pure virtual]
```

Clones this abstract value.

Returns

A pointer to a clone of this abstract value.

Implemented in [mage::Variable::Value< T >](#).

5.2.3.2 GetValue()

```
virtual const void* mage::Variable::AbstractValue::GetValue ( ) const [pure virtual]
```

Returns the value of this abstract value.

Returns

A pointer to the value of this abstract value.

Implemented in [mage::Variable::Value< T >](#).

5.2.3.3 operator=() [1/2]

```
AbstractValue& mage::Variable::AbstractValue::operator= (
    const AbstractValue & abstract_value ) [delete]
```

Copies the given abstract value to this abstract value.

Parameters

| | | |
|----|-----------------------|--|
| in | <i>abstract_value</i> | A reference to the abstract value to copy. |
|----|-----------------------|--|

Returns

A reference to the copy of the given abstract value (i.e. this abstract value).

5.2.3.4 operator=() [2/2]

```
AbstractValue& mage::Variable::AbstractValue::operator= (
    AbstractValue && abstract_value ) [delete]
```

Moves the given abstract value to this abstract value.

Parameters

| | | |
|----|-----------------------|--|
| in | <i>abstract_value</i> | A reference to the abstract value to move. |
|----|-----------------------|--|

Returns

A reference to the moved abstract value (i.e. this abstract value).

5.3 mage::AlignedData< DataT > Struct Template Reference

```
#include <allocation.hpp>
```

Static Public Member Functions

- static void * **operator new** (size_t size)
- static void **operator delete** (void *ptr)
- static void * **operator new[]** (size_t size)
- static void **operator delete[]** (void *ptr)

5.3.1 Detailed Description

```
template<typename DataT>
struct mage::AlignedData< DataT >
```

A struct of aligned data.

Template Parameters

| | |
|------------|------------|
| <i>The</i> | data type. |
|------------|------------|

5.3.2 Member Function Documentation

5.3.2.1 operator delete()

```
template<typename DataT >
static void mage::AlignedData< DataT >::operator delete (
    void * ptr ) [static]
```

Deallocates the memory block pointed by *ptr* (if not `nullptr`), releasing the storage space previously allocated to it by a call to operator new and rendering that pointer location invalid.

Parameters

| | | |
|----|------------|---|
| in | <i>ptr</i> | A pointer to the memory block that was allocated. |
|----|------------|---|

5.3.2.2 operator delete[]()

```
template<typename DataT >
static void mage::AlignedData< DataT >::operator delete[ ] (
    void * ptr ) [static]
```

Deallocates the memory block pointed to by *ptr* (if not `nullptr`), releasing the storage space previously allocated to it by a call to operator new[] and rendering that pointer location invalid.

Parameters

| | | |
|----|------------|---|
| in | <i>ptr</i> | A pointer to the memory block that was allocated. |
|----|------------|---|

5.3.2.3 operator new()

```
template<typename DataT >
static void* mage::AlignedData< DataT >::operator new (
    size_t size ) [static]
```

Allocates *size* bytes of storage, suitably aligned to represent any object of that size, and returns a non-null pointer to the first byte of this block.

Parameters

| | | |
|----|-------------|--|
| in | <i>size</i> | The requested size in bytes to allocate in memory. |
|----|-------------|--|

Returns

A pointer to the memory block that was allocated. The pointer is a multiple of the given alignment.

Exceptions

| | |
|------------------|--------------------------------------|
| <i>bad_alloc</i> | Failed to allocate the memory block. |
|------------------|--------------------------------------|

5.3.2.4 operator new[]()

```
template<typename DataT >
static void* mage::AlignedData< DataT >::operator new[ ] (
    size_t size ) [static]
```

Allocates *size* bytes of storage, suitably aligned to represent any object of that size, and returns a non-null pointer to the first byte of this block.

Parameters

| | | |
|----|------|--|
| in | size | The requested size in bytes to allocate in memory. |
|----|------|--|

Returns

A pointer to the memory block that was allocated. The pointer is a multiple of the given alignment.

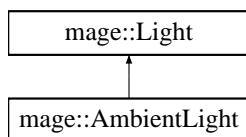
Exceptions

| | |
|-----------|--------------------------------------|
| bad_alloc | Failed to allocate the memory block. |
|-----------|--------------------------------------|

5.4 mage::AmbientLight Class Reference

```
#include <ambient_light.hpp>
```

Inheritance diagram for mage::AmbientLight:



Public Member Functions

- [AmbientLight \(const RGBSpectrum &intensity=RGBSpectrum\(1.0f, 1.0f, 1.0f\)\)](#)
- [AmbientLight \(const AmbientLight &light\)](#)
- [AmbientLight \(AmbientLight &&light\)](#)
- [virtual ~AmbientLight \(\)](#)
- [AmbientLight & operator= \(const AmbientLight &light\)](#)
- [AmbientLight & operator= \(AmbientLight &&light\)](#)
- [UniquePtr< AmbientLight > Clone \(\) const](#)

Private Member Functions

- [virtual UniquePtr< Light > ClonImplementation \(\) const override](#)

Additional Inherited Members

5.4.1 Detailed Description

A class of ambient lights.

5.4.2 Constructor & Destructor Documentation

5.4.2.1 AmbientLight() [1/3]

```
mage::AmbientLight::AmbientLight (
    const RGBSpectrum & intensity = RGBSpectrum(1.0f, 1.0f, 1.0f) ) [explicit]
```

Constructs an ambient light.

Parameters

| | | |
|----|------------------|--------------------|
| in | <i>intensity</i> | The RGB intensity. |
|----|------------------|--------------------|

5.4.2.2 AmbientLight() [2/3]

```
mage::AmbientLight::AmbientLight (
    const AmbientLight & light ) [default]
```

Constructs an ambient light from the given ambient light.

Parameters

| | | |
|----|--------------|---|
| in | <i>light</i> | A reference to the ambient light to copy. |
|----|--------------|---|

5.4.2.3 AmbientLight() [3/3]

```
mage::AmbientLight::AmbientLight (
    AmbientLight && light ) [default]
```

Constructs an ambient light by moving the given ambient light.

Parameters

| | | |
|----|--------------|---|
| in | <i>light</i> | A reference to the ambient light to move. |
|----|--------------|---|

5.4.2.4 ~AmbientLight()

```
mage::AmbientLight::~AmbientLight ( ) [virtual], [default]
```

Destructs this ambient light.

5.4.3 Member Function Documentation

5.4.3.1 Clone()

```
UniquePtr< AmbientLight > mage::AmbientLight::Clone() const
```

Clones this ambient light.

Returns

A pointer to the clone of this ambient light.

5.4.3.2 CloneImplementation()

```
UniquePtr< Light > mage::AmbientLight::CloneImplementation() const [override], [private], [virtual]
```

Clones this ambient light.

Returns

A pointer to the clone of this ambient light.

Implements [mage::Light](#).

5.4.3.3 operator=() [1/2]

```
AmbientLight & mage::AmbientLight::operator= (
    const AmbientLight & light) [default]
```

Copies the given ambient light to this ambient light.

Parameters

| | | |
|----|--------------|---|
| in | <i>light</i> | A reference to the ambient light to copy. |
|----|--------------|---|

Returns

A reference to the copy of the given ambient light (i.e. this ambient light).

5.4.3.4 operator=() [2/2]

```
AmbientLight & mage::AmbientLight::operator= (
    AmbientLight && light) [default]
```

Moves the given ambient light to this ambient light.

Parameters

| | | |
|----|--------------|---|
| in | <i>light</i> | A reference to the ambient light to move. |
|----|--------------|---|

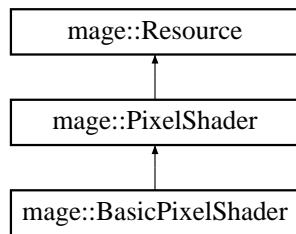
Returns

A reference to the moved ambient light (i.e. this ambient light).

5.5 mage::BasicPixelShader Class Reference

```
#include <basic_shader.hpp>
```

Inheritance diagram for mage::BasicPixelShader:



Public Member Functions

- [BasicPixelShader \(ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const wstring &fname\)](#)
- [BasicPixelShader \(ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const CompiledPixelShader &compiled_pixel_shader\)](#)
- [BasicPixelShader \(const BasicPixelShader &pixel_shader\)=delete](#)
- [BasicPixelShader \(BasicPixelShader &&pixel_shader\)](#)
- [virtual ~BasicPixelShader \(\)](#)
- [BasicPixelShader & operator= \(const BasicPixelShader &pixel_shader\)=delete](#)
- [BasicPixelShader & operator= \(BasicPixelShader &&pixel_shader\)=delete](#)
- [virtual void PrepareShading \(const Material &material, const Lighting &lighting\) const override final](#)

Private Attributes

- [ConstantBuffer< MaterialBuffer > m_material_buffer](#)

Additional Inherited Members

5.5.1 Detailed Description

A class of basic pixel shaders.

5.5.2 Constructor & Destructor Documentation

5.5.2.1 BasicPixelShader() [1/4]

```
mage::BasicPixelShader::BasicPixelShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const wstring & fname ) [explicit]
```

Constructs a basic pixel shader.

Precondition

device is not equal to nullptr.
device_context is not equal to nullptr.

Parameters

| | | |
|----|-----------------------|----------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>fname</i> | A reference to the filename. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to initialize this pixel shader. |
|---------------------------|---|

5.5.2.2 BasicPixelShader() [2/4]

```
mage::BasicPixelShader::BasicPixelShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const CompiledPixelShader & compiled_pixel_shader ) [explicit]
```

Constructs a basic pixel shader.

Precondition

device is not equal to nullptr.
device_context is not equal to nullptr.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>compiled_pixel_shader</i> | A reference to the compiled pixel shader. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to initialize this pixel shader. |
|---------------------------|---|

5.5.2.3 BasicPixelShader() [3/4]

```
mage::BasicPixelShader::BasicPixelShader (
    const BasicPixelShader & pixel_shader ) [delete]
```

Constructs a basic pixel shader from the given basic pixel shader.

Parameters

| | | |
|----|---------------------|--|
| in | <i>pixel_shader</i> | A reference to the basic pixel shader to copy. |
|----|---------------------|--|

5.5.2.4 BasicPixelShader() [4/4]

```
mage::BasicPixelShader::BasicPixelShader (
    BasicPixelShader && pixel_shader ) [default]
```

Constructs a basic pixel shader by moving the given basic pixel shader.

Parameters

| | | |
|----|---------------------|--|
| in | <i>pixel_shader</i> | A reference to the basic pixel shader to move. |
|----|---------------------|--|

5.5.2.5 ~BasicPixelShader()

```
mage::BasicPixelShader::~BasicPixelShader ( ) [virtual], [default]
```

Destructs this basic pixel shader.

5.5.3 Member Function Documentation

5.5.3.1 operator=() [1/2]

```
BasicPixelShader& mage::BasicPixelShader::operator= (
    const BasicPixelShader & pixel_shader ) [delete]
```

Copies the given basic pixel shader to this basic pixel shader.

Parameters

| | | |
|----|---------------------|--|
| in | <i>pixel_shader</i> | A reference to the basic pixel shader to copy. |
|----|---------------------|--|

Returns

A reference to the copy of the given basic pixel shader (i.e. this basic pixel shader).

5.5.3.2 operator=() [2/2]

```
BasicPixelShader& mage::BasicPixelShader::operator= (
    BasicPixelShader && pixel_shader ) [delete]
```

Moves the given basic pixel shader to this basic pixel shader.

Parameters

| | | |
|----|---------------------|--|
| in | <i>pixel_shader</i> | A reference to the basic pixel shader to move. |
|----|---------------------|--|

Returns

A reference to the moved basic pixel shader (i.e. this basic pixel shader).

5.5.3.3 PrepareShading()

```
void mage::BasicPixelShader::PrepareShading (
    const Material & material,
    const Lighting & lighting ) const [final], [override], [virtual]
```

Prepares this basic pixel shader for shading.

Parameters

| | | |
|----|-----------------|-------------------------------------|
| in | <i>material</i> | A reference to the material. |
| in | <i>lighting</i> | A reference to the lighting buffer. |

Reimplemented from [mage::PixelShader](#).

5.5.4 Member Data Documentation

5.5.4.1 m_material_buffer

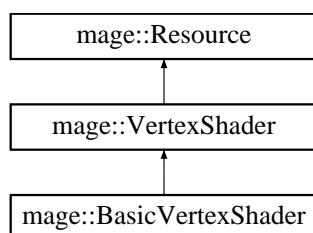
```
ConstantBuffer< MaterialBuffer > mage::BasicPixelShader::m_material_buffer [private]
```

A pointer to the material buffer of this basic pixel shader.

5.6 mage::BasicVertexShader Class Reference

```
#include <basic_shader.hpp>
```

Inheritance diagram for mage::BasicVertexShader:



Public Member Functions

- `BasicVertexShader` (`ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const wstring &fname)`
- `BasicVertexShader` (`ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const CompiledVertexShader &compiled_vertex_shader)`
- `BasicVertexShader` (`const BasicVertexShader &vertex_shader)=delete`
- `BasicVertexShader` (`BasicVertexShader &&vertex_shader)`
- `virtual ~BasicVertexShader ()`
- `BasicVertexShader & operator=` (`const BasicVertexShader &vertex_shader)=delete`
- `BasicVertexShader & operator=` (`BasicVertexShader &&vertex_shader)=delete`
- `virtual void PrepareShading` (`ID3D11Buffer *transform`) `const override final`

Additional Inherited Members

5.6.1 Detailed Description

A class of basic vertex shaders.

5.6.2 Constructor & Destructor Documentation

5.6.2.1 BasicVertexShader() [1/4]

```
mage::BasicVertexShader::BasicVertexShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const wstring & fname ) [explicit]
```

Constructs a basic vertex shader.

Precondition

`device` is not equal to `nullptr`.
`device_context` is not equal to `nullptr`.

Parameters

| | | |
|----|-----------------------------|----------------------------------|
| in | <code>device</code> | A pointer to the device. |
| in | <code>device_context</code> | A pointer to the device context. |
| in | <code>fname</code> | A reference to the filename. |

Exceptions

| | |
|---------------------------------|--|
| <code>FormattedException</code> | Failed to initialize this vertex shader. |
|---------------------------------|--|

5.6.2.2 BasicVertexShader() [2/4]

```
mage::BasicVertexShader::BasicVertexShader (
```

```
ID3D11Device2 * device,
ID3D11DeviceContext2 * device_context,
const CompiledVertexShader & compiled_vertex_shader ) [explicit]
```

Constructs a basic vertex shader.

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------------------|--|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>compiled_vertex_shader</i> | A reference to the compiled vertex shader. |

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to initialize this vertex shader. |
|---------------------------|--|

5.6.2.3 BasicVertexShader() [3/4]

```
mage::BasicVertexShader::BasicVertexShader (
    const BasicVertexShader & vertex_shader ) [delete]
```

Constructs a basic vertex shader from the given basic vertex shader.

Parameters

| | | |
|----|----------------------|---|
| in | <i>vertex_shader</i> | A reference to the basic vertex shader to copy. |
|----|----------------------|---|

5.6.2.4 BasicVertexShader() [4/4]

```
mage::BasicVertexShader::BasicVertexShader (
    BasicVertexShader && vertex_shader ) [default]
```

Constructs a basic vertex shader by moving the given basic vertex shader.

Parameters

| | | |
|----|----------------------|---|
| in | <i>vertex_shader</i> | A reference to the basic vertex shader to move. |
|----|----------------------|---|

5.6.2.5 ~BasicVertexShader()

```
mage::BasicVertexShader::~BasicVertexShader ( ) [virtual], [default]
```

Destructs this basic vertex shader.

5.6.3 Member Function Documentation

5.6.3.1 operator=() [1/2]

```
BasicVertexShader& mage::BasicVertexShader::operator= (
    const BasicVertexShader & vertex_shader ) [delete]
```

Copies the given basic vertex shader to this basic vertex shader.

Parameters

| | | |
|----|----------------------|---|
| in | <i>vertex_shader</i> | A reference to the basic vertex shader to copy. |
|----|----------------------|---|

Returns

A reference to the copy of the given basic vertex shader (i.e. this basic vertex shader).

5.6.3.2 operator=() [2/2]

```
BasicVertexShader& mage::BasicVertexShader::operator= (
    BasicVertexShader && vertex_shader ) [delete]
```

Copies the given basic vertex shader to this basic vertex shader.

Parameters

| | | |
|----|----------------------|---|
| in | <i>vertex_shader</i> | A reference to the basic vertex shader to copy. |
|----|----------------------|---|

Returns

A reference to the moved basic vertex shader (i.e. this basic vertex shader).

5.6.3.3 PrepareShading()

```
void mage::BasicVertexShader::PrepareShading (
    ID3D11Buffer * transform ) const [final], [override], [virtual]
```

Prepares this basic vertex shader for shading.

Precondition

transform is not equal to `nullptr`.

Parameters

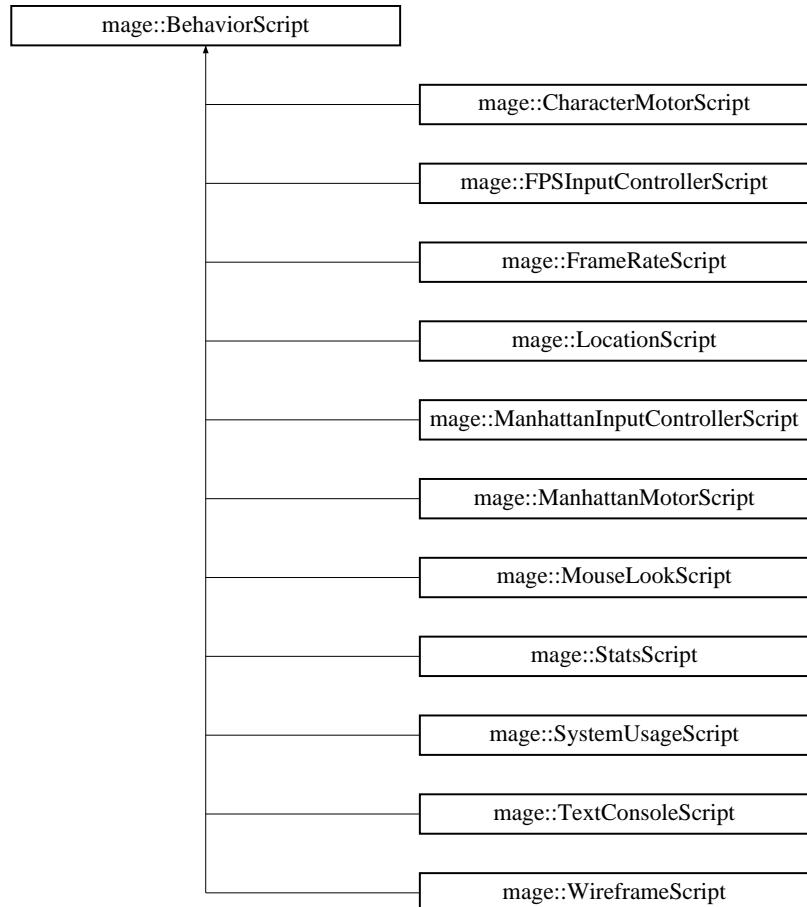
| | | |
|----|------------------|------------------------------------|
| in | <i>transform</i> | A pointer to the transform buffer. |
|----|------------------|------------------------------------|

Reimplemented from [mage::VertexShader](#).

5.7 mage::BehaviorScript Class Reference

```
#include <behavior_script.hpp>
```

Inheritance diagram for mage::BehaviorScript:



Public Member Functions

- virtual [~BehaviorScript \(\)](#)
- [BehaviorScript & operator= \(const BehaviorScript &script\)=delete](#)
- [BehaviorScript & operator= \(BehaviorScript &&script\)=delete](#)
- virtual void [Update \(double delta_time\)=0](#)

Protected Member Functions

- [BehaviorScript \(\)](#)
- [BehaviorScript \(const BehaviorScript &script\)](#)
- [BehaviorScript \(BehaviorScript &&script\)](#)

5.7.1 Detailed Description

A class of behavior scripts.

5.7.2 Constructor & Destructor Documentation

5.7.2.1 ~BehaviorScript()

```
mage::BehaviorScript::~BehaviorScript ( ) [virtual], [default]
```

Destructs this behavior script.

5.7.2.2 BehaviorScript() [1/3]

```
mage::BehaviorScript::BehaviorScript ( ) [protected], [default]
```

Constructs a behavior script.

5.7.2.3 BehaviorScript() [2/3]

```
mage::BehaviorScript::BehaviorScript (
    const BehaviorScript & script ) [protected], [default]
```

Constructs a behavior script from the given behavior script.

Parameters

| | | |
|----|--------|---|
| in | script | A reference to the behavior script to copy. |
|----|--------|---|

5.7.2.4 BehaviorScript() [3/3]

```
mage::BehaviorScript::BehaviorScript (
    BehaviorScript && script ) [protected], [default]
```

Constructs a behavior script by moving the given behavior script.

Parameters

| | | |
|----|--------|---|
| in | script | A reference to the behavior script to move. |
|----|--------|---|

5.7.3 Member Function Documentation

5.7.3.1 operator=() [1/2]

```
BehaviorScript& mage::BehaviorScript::operator= (
```

```
const BehaviorScript & script ) [delete]
```

Copies the given behavior script to this behavior script.

Parameters

| | | |
|----|--------|---|
| in | script | A reference to the behavior script to copy. |
|----|--------|---|

Returns

A reference to the copy of the given behavior script (i.e. this behavior script).

5.7.3.2 operator=() [2/2]

```
BehaviorScript& mage::BehaviorScript::operator= (
    BehaviorScript && script ) [delete]
```

Moves the given behavior script to this behavior script.

Parameters

| | | |
|----|--------|---|
| in | script | A reference to the behavior script to move. |
|----|--------|---|

Returns

A reference to the moved behavior script (i.e. this behavior script).

5.7.3.3 Update()

```
virtual void mage::BehaviorScript::Update (
    double delta_time ) [pure virtual]
```

Updates this behavior script.

Parameters

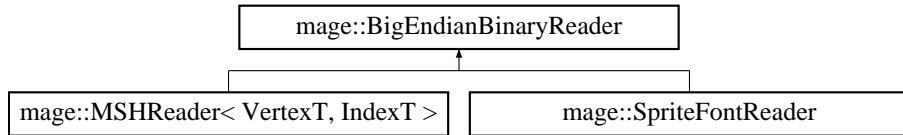
| | | |
|----|------------|---|
| in | delta_time | The elapsed time since the previous update. |
|----|------------|---|

Implemented in [mage::WireframeScript](#), [mage::MouseLookScript](#), [mage::TextConsoleScript](#), [mage::StatsScript](#), [mage::SystemUsageScript](#), [mage::FrameRateScript](#), [mage::FPSInputControllerScript](#), [mage::LocationScript](#), [mage::ManhattanInputControllerScript](#), [mage::CharacterMotorScript](#), and [mage::ManhattanMotorScript](#).

5.8 mage::BigEndianBinaryReader Class Reference

```
#include <binary_reader.hpp>
```

Inheritance diagram for mage::BigEndianBinaryReader:



Public Member Functions

- virtual `~BigEndianBinaryReader ()`
- `BigEndianBinaryReader & operator= (const BigEndianBinaryReader &reader)=delete`
- `BigEndianBinaryReader & operator= (BigEndianBinaryReader &&reader)=delete`
- void `ReadFromFile (const wstring &fname)`
- void `ReadFromMemory (const uint8_t *input, size_t size)`
- const wstring & `GetFilename () const`

Protected Member Functions

- `BigEndianBinaryReader ()`
- `BigEndianBinaryReader (const BigEndianBinaryReader &reader)=delete`
- `BigEndianBinaryReader (BigEndianBinaryReader &&reader)`
- bool `HasCharsLeft () const`
- template<typename DataT >
 `const DataT & ReadValue ()`
- template<typename DataT >
 `const DataT * ReadValueArray (size_t count)`

Private Member Functions

- virtual void `Read ()=0`

Private Attributes

- wstring `m_fname`
- const uint8_t * `m_pos`
- const uint8_t * `m_end`
- `UniquePtr< uint8_t[] > m_data`

5.8.1 Detailed Description

A class of readers for reading (big endian) binary files.

5.8.2 Constructor & Destructor Documentation

5.8.2.1 `~BigEndianBinaryReader()`

```
mage::BigEndianBinaryReader::~BigEndianBinaryReader ( ) [virtual], [default]
```

Destructs this big endian binary reader.

5.8.2.2 BigEndianBinaryReader() [1/3]

```
mage::BigEndianBinaryReader::BigEndianBinaryReader ( ) [protected]
```

Constructs a big endian binary reader.

5.8.2.3 BigEndianBinaryReader() [2/3]

```
mage::BigEndianBinaryReader::BigEndianBinaryReader ( const BigEndianBinaryReader & reader ) [protected], [delete]
```

Constructs a big endian binary reader from the given big endian binary reader.

Parameters

| | | |
|----|--------|--|
| in | reader | A reference to the big endian binary reader to copy. |
|----|--------|--|

5.8.2.4 BigEndianBinaryReader() [3/3]

```
mage::BigEndianBinaryReader::BigEndianBinaryReader ( BigEndianBinaryReader && reader ) [protected], [default]
```

Constructs a big endian binary reader by moving the given big endian binary reader.

Parameters

| | | |
|----|--------|--|
| in | reader | A reference to the big endian binary reader to move. |
|----|--------|--|

5.8.3 Member Function Documentation

5.8.3.1 GetFilename()

```
const wstring& mage::BigEndianBinaryReader::GetFilename ( ) const
```

Returns the current filename of this big endian binary reader.

Returns

A reference to the current filename of this big endian binary reader.

5.8.3.2 HasCharsLeft()

```
bool mage::BigEndianBinaryReader::HasCharsLeft ( ) const [protected]
```

Checks if there are characters left to read by this binary reader.

Returns

true if there are characters left to read by this binary reader. false otherwise.

5.8.3.3 operator=() [1/2]

```
BigEndianBinaryReader& mage::BigEndianBinaryReader::operator= (
    const BigEndianBinaryReader & reader ) [delete]
```

Copies the given big endian binary reader to this big endian binary reader.

Parameters

| | | |
|----|--------|--|
| in | reader | A reference to a big endian binary reader to copy. |
|----|--------|--|

Returns

A reference to the copy of the given big endian binary reader (i.e. this big endian binary reader).

5.8.3.4 operator=() [2/2]

```
BigEndianBinaryReader& mage::BigEndianBinaryReader::operator= (
    BigEndianBinaryReader && reader ) [delete]
```

Moves the given big endian binary reader to this big endian binary reader.

Parameters

| | | |
|----|--------|--|
| in | reader | A reference to a big endian binary reader to move. |
|----|--------|--|

Returns

A reference to the moved big endian binary reader (i.e. this big endian binary reader).

5.8.3.5 Read()

```
virtual void mage::BigEndianBinaryReader::Read ( ) [private], [pure virtual]
```

Starts reading.

Exceptions

| | |
|--------------------|-----------------------------------|
| FormattedException | Failed to read to the given file. |
|--------------------|-----------------------------------|

Implemented in [mage::MSHReader< VertexT, IndexT >](#), and [mage::SpriteFontReader](#).

5.8.3.6 ReadFromFile()

```
void mage::BigEndianBinaryReader::ReadFromFile (
    const wstring & fname )
```

Reads from the given file.

Parameters

| | | |
|----|--------------|-------------------------------|
| in | <i>fname</i> | A reference to the file name. |
|----|--------------|-------------------------------|

Exceptions

| | |
|---------------------------|-------------------------------------|
| <i>FormattedException</i> | Failed to read from the given file. |
|---------------------------|-------------------------------------|

5.8.3.7 ReadFromMemory()

```
void mage::BigEndianBinaryReader::ReadFromMemory (
    const uint8_t * input,
    size_t size )
```

Reads the input string.

Precondition

input is not equal to `nullptr`.

Parameters

| | | |
|----|--------------|-------------------------------------|
| in | <i>input</i> | A pointer to the input byte string. |
| in | <i>size</i> | The size of the input string. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read from the given input string. |
|---------------------------|---|

5.8.3.8 ReadValue()

```
template<typename DataT >
const DataT& mage::BigEndianBinaryReader::ReadValue ( ) [protected]
```

Reads a `DataT` element.

Template Parameters

| | |
|--------------|----------------|
| <i>DataT</i> | The data type. |
|--------------|----------------|

Returns

A reference to the `DataT` element read.

Exceptions

| | |
|---------------------------|---------------------------------|
| <i>FormattedException</i> | Failed to read a DataT element. |
|---------------------------|---------------------------------|

5.8.3.9 ReadValueArray()

```
template<typename DataT >
const DataT* mage::BigEndianBinaryReader::ReadValueArray (
    size_t count ) [protected]
```

Reads an array of DataT elements.

Template Parameters

| | |
|--------------|----------------|
| <i>DataT</i> | The data type. |
|--------------|----------------|

Parameters

| | |
|--------------|---------------------------------------|
| <i>count</i> | The number of DataT elements to read. |
|--------------|---------------------------------------|

Returns

A pointer to the array of DataT element read.

Exceptions

| | |
|---------------------------|--------------------------------------|
| <i>FormattedException</i> | Failed to read count DataT elements. |
|---------------------------|--------------------------------------|

5.8.4 Member Data Documentation**5.8.4.1 m_data**

```
UniquePtr< uint8_t[] > mage::BigEndianBinaryReader::m_data [private]
```

A pointer to the data to read of this binary reader.

5.8.4.2 m_end

```
const uint8_t* mage::BigEndianBinaryReader::m_end [private]
```

A pointer to the end position of this binary reader.

5.8.4.3 m_fname

```
wstring mage::BigEndianBinaryReader::m_fname [private]
```

The current filename of this line reader.

5.8.4.4 m_pos

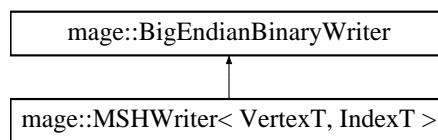
```
const uint8_t* mage::BigEndianBinaryReader::m_pos [private]
```

A pointer to the current position of this binary reader.

5.9 mage::BigEndianBinaryWriter Class Reference

```
#include <binary_writer.hpp>
```

Inheritance diagram for mage::BigEndianBinaryWriter:



Public Member Functions

- virtual ~BigEndianBinaryWriter ()
- BigEndianBinaryWriter & operator= (const BigEndianBinaryWriter &writer)=delete
- BigEndianBinaryWriter & operator= (BigEndianBinaryWriter &&writer)=delete
- void WriteToFile (const wstring &fname)
- const wstring & GetFilename () const

Protected Member Functions

- BigEndianBinaryWriter ()
- BigEndianBinaryWriter (const BigEndianBinaryWriter &writer)=delete
- BigEndianBinaryWriter (BigEndianBinaryWriter &&writer)
- template<typename DataT >
void WriteValue (const DataT &data)
- template<typename DataT >
void WriteValueArray (const DataT *data, size_t count)
- void WriteCharacter (char c)
- void WriteString (const char *str)
- void WriteString (const string &str)

Private Member Functions

- virtual void Write ()=0

Private Attributes

- UniqueFileStream m_file_stream
- wstring m_fname

5.9.1 Detailed Description

A class of writers for writing (big endian) binary files.

5.9.2 Constructor & Destructor Documentation

5.9.2.1 ~BigEndianBinaryWriter()

```
mage::BigEndianBinaryWriter::~BigEndianBinaryWriter () [virtual], [default]
```

Destructs this big endian binary writer.

5.9.2.2 BigEndianBinaryWriter() [1/3]

```
mage::BigEndianBinaryWriter::BigEndianBinaryWriter () [protected]
```

Constructs a big endian binary writer.

5.9.2.3 BigEndianBinaryWriter() [2/3]

```
mage::BigEndianBinaryWriter::BigEndianBinaryWriter (
    const BigEndianBinaryWriter & writer ) [protected], [delete]
```

Constructs a big endian binary writer from the given big endian binary writer.

Parameters

| | | |
|----|---------------|--|
| in | <i>writer</i> | A reference to the big endian binary writer to copy. |
|----|---------------|--|

5.9.2.4 BigEndianBinaryWriter() [3/3]

```
mage::BigEndianBinaryWriter::BigEndianBinaryWriter (
    BigEndianBinaryWriter && writer ) [protected], [default]
```

Constructs a big endian binary writer by moving the given big endian binary writer.

Parameters

| | | |
|----|---------------|--|
| in | <i>writer</i> | A reference to the big endian binary writer to move. |
|----|---------------|--|

5.9.3 Member Function Documentation

5.9.3.1 GetFilename()

```
const wstring& mage::BigEndianBinaryWriter::GetFilename () const
```

Returns the current filename of this writer.

Returns

A reference to the current filename of this writer.

5.9.3.2 operator=() [1/2]

```
BigEndianBinaryWriter& mage::BigEndianBinaryWriter::operator= (
    const BigEndianBinaryWriter & writer ) [delete]
```

Copies the given big endian binary writer to this big endian binary writer.

Parameters

| | | |
|----|--------|--|
| in | writer | A reference to a big endian binary writer to copy. |
|----|--------|--|

Returns

A reference to the copy of the given big endian binary writer (i.e. this big endian binary writer).

5.9.3.3 operator=() [2/2]

```
BigEndianBinaryWriter& mage::BigEndianBinaryWriter::operator= (
    BigEndianBinaryWriter && writer ) [delete]
```

Moves the given big endian binary writer to this big endian binary writer.

Parameters

| | | |
|----|--------|--|
| in | writer | A reference to a big endian binary writer to move. |
|----|--------|--|

Returns

A reference to the moved big endian binary writer (i.e. this big endian binary writer).

5.9.3.4 Write()

```
virtual void mage::BigEndianBinaryWriter::Write ( ) [private], [pure virtual]
```

Starts writing.

Exceptions

| | |
|--------------------|------------------|
| FormattedException | Failed to write. |
|--------------------|------------------|

Implemented in [mage::MSHWriter< VertexT, IndexT >](#).

5.9.3.5 WriteCharacter()

```
void mage::BigEndianBinaryWriter::WriteCharacter (
    char c )  [protected]
```

Writes the given character.

Parameters

| | | |
|----|---|-------------------------|
| in | c | The character to write. |
|----|---|-------------------------|

Exceptions

| | |
|------------------------------------|--------------------------------------|
| FormattedException | Failed to write the given character. |
|------------------------------------|--------------------------------------|

5.9.3.6 WriteString() [1/2]

```
void mage::BigEndianBinaryWriter::WriteString (
    const char * str )  [protected]
```

Writes the given string.

Precondition

str is not equal to `nullptr`.

Parameters

| | | |
|----|-----|--|
| in | str | A pointer to the first null-terminated byte string to write. |
|----|-----|--|

Exceptions

| | |
|------------------------------------|-----------------------------------|
| FormattedException | Failed to write the given string. |
|------------------------------------|-----------------------------------|

5.9.3.7 WriteString() [2/2]

```
void mage::BigEndianBinaryWriter::WriteString (
    const string & str )  [protected]
```

Writes the given string.

Parameters

| | | |
|----|-----|-------------------------------------|
| in | str | A reference to the string to write. |
|----|-----|-------------------------------------|

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to write the given string. |
|---------------------------|-----------------------------------|

5.9.3.8 WriteToFile()

```
void mage::BigEndianBinaryWriter::WriteToFile (
    const wstring & fname )
```

Writes to the given file.

Parameters

| | | |
|-----------|--------------|-------------------------------|
| <i>in</i> | <i>fname</i> | A reference to the file name. |
|-----------|--------------|-------------------------------|

Exceptions

| | |
|---------------------------|------------------------------------|
| <i>FormattedException</i> | Failed to write to the given file. |
|---------------------------|------------------------------------|

5.9.3.9 WriteValue()

```
template<typename DataT >
void mage::BigEndianBinaryWriter::WriteValue (
    const DataT & data ) [protected]
```

Writes the given data.

Template Parameters

| | |
|--------------|----------------|
| <i>DataT</i> | The data type. |
|--------------|----------------|

Parameters

| | | |
|-----------|-------------|--------------------------|
| <i>in</i> | <i>data</i> | A reference to the data. |
|-----------|-------------|--------------------------|

Exceptions

| | |
|---------------------------|---------------------------------|
| <i>FormattedException</i> | Failed to write the given data. |
|---------------------------|---------------------------------|

5.9.3.10 WriteValueArray()

```
template<typename DataT >
void mage::BigEndianBinaryWriter::WriteValueArray (
    const DataT * data,
    size_t count ) [protected]
```

Writes the given data.

Precondition

- data* is not equal to `nullptr`.
- The array pointed to by *data* contains at least *count* elements.

Template Parameters

| | |
|--------------|----------------|
| <i>DataT</i> | The data type. |
|--------------|----------------|

Parameters

| | | |
|----|--------------|---|
| in | <i>data</i> | A pointer to the data. |
| in | <i>count</i> | The number of data elements of <code>size(DataT)</code> to write. |

Exceptions

| | |
|---------------------------|---------------------------------|
| <i>FormattedException</i> | Failed to write the given data. |
|---------------------------|---------------------------------|

5.9.4 Member Data Documentation

5.9.4.1 m_file_stream

`UniqueFileStream mage::BigEndianBinaryWriter::m_file_stream [private]`

A pointer to the file stream of this big endian binary writer.

5.9.4.2 m_fname

`wstring mage::BigEndianBinaryWriter::m_fname [private]`

The current filename of this big endian binary writer.

5.10 mage::BinaryReader Class Reference

```
#include <binary_reader.hpp>
```

Public Member Functions

- virtual `~BinaryReader ()`
- `BinaryReader & operator= (const BinaryReader &reader)=delete`
- `BinaryReader & operator= (BinaryReader &&reader)=delete`
- void `ReadFromFile (const wstring &fname, bool big_endian)`
- void `ReadFromMemory (const uint8_t *input, size_t size, bool big_endian)`
- const `wstring & GetFilename () const`

Protected Member Functions

- `BinaryReader ()`
- `BinaryReader (const BinaryReader &reader)=delete`
- `BinaryReader (BinaryReader &&reader)`
- `bool HasCharsLeft () const`
- `const char * ReadChars (size_t size)`
- `int8_t ReadInt8 ()`
- `uint8_t ReadUInt8 ()`
- `int16_t ReadInt16 ()`
- `uint16_t ReadUInt16 ()`
- `int32_t ReadInt32 ()`
- `uint32_t ReadUInt32 ()`
- `int64_t ReadInt64 ()`
- `uint64_t ReadUInt64 ()`
- `float ReadFloat ()`
- `double ReadDouble ()`

Private Member Functions

- `virtual void Read ()=0`

Private Attributes

- `wstring m_fname`
- `bool m_big_endian`
- `const uint8_t * m_pos`
- `const uint8_t * m_end`
- `UniquePtr< uint8_t[] > m_data`

5.10.1 Detailed Description

A class of readers for reading binary files.

5.10.2 Constructor & Destructor Documentation

5.10.2.1 ~BinaryReader()

```
mage::BinaryReader::~BinaryReader ( ) [virtual], [default]
```

Destructs this binary reader.

5.10.2.2 BinaryReader() [1/3]

```
mage::BinaryReader::BinaryReader ( ) [protected]
```

Constructs a binary reader.

5.10.2.3 BinaryReader() [2/3]

```
mage::BinaryReader::BinaryReader (   
        const BinaryReader & reader ) [protected], [delete]
```

Constructs a binary reader from the given binary reader.

Parameters

| | | |
|----|---------------------|---|
| in | <code>reader</code> | A reference to the binary reader to copy. |
|----|---------------------|---|

5.10.2.4 BinaryReader() [3/3]

```
mage::BinaryReader::BinaryReader (
    BinaryReader && reader ) [protected], [default]
```

Constructs a binary reader by moving the given binary reader.

Parameters

| | | |
|----|---------------------|---|
| in | <code>reader</code> | A reference to the binary reader to move. |
|----|---------------------|---|

5.10.3 Member Function Documentation**5.10.3.1 GetFilename()**

```
const wstring& mage::BinaryReader::GetFilename ( ) const
```

Returns the current filename of this binary reader.

Returns

A reference to the current filename of this binary reader.

5.10.3.2 HasCharsLeft()

```
bool mage::BinaryReader::HasCharsLeft ( ) const [protected]
```

Checks if there are characters left to read by this binary reader.

Returns

`true` if there are characters left to read by this binary reader. `false` otherwise.

5.10.3.3 operator=() [1/2]

```
BinaryReader& mage::BinaryReader::operator= (
    const BinaryReader & reader ) [delete]
```

Copies the given binary reader to this binary reader.

Parameters

| | | |
|----|--------|---|
| in | reader | A reference to a binary reader to copy. |
|----|--------|---|

Returns

A reference to the copy of the given binary reader (i.e. this binary reader).

5.10.3.4 operator=() [2/2]

```
BinaryReader& mage::BinaryReader::operator= (
    BinaryReader && reader ) [delete]
```

Moves the given binary reader to this binary reader.

Parameters

| | | |
|----|--------|---|
| in | reader | A reference to a binary reader to move. |
|----|--------|---|

Returns

A reference to the moved binary reader (i.e. this binary reader).

5.10.3.5 Read()

```
virtual void mage::BinaryReader::Read ( ) [private], [pure virtual]
```

Starts reading.

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to read to the given file. |
|---------------------------|-----------------------------------|

5.10.3.6 ReadChars()

```
const char * mage::BinaryReader::ReadChars (
    size_t size ) [protected]
```

Reads an array of byte characters.

Parameters

| | |
|------|------------------------------|
| size | The number of bytes to read. |
|------|------------------------------|

Returns

A pointer to the array of characters read.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read <code>size</code> bytes. |
|---------------------------|---|

5.10.3.7 ReadDouble()

```
double mage::BinaryReader::ReadDouble () [protected]
```

Reads a double.

Returns

The double read.

Exceptions

| | |
|---------------------------|--------------------------|
| <i>FormattedException</i> | Failed to read a double. |
|---------------------------|--------------------------|

5.10.3.8 ReadFloat()

```
float mage::BinaryReader::ReadFloat () [protected]
```

Reads a float.

Returns

The float read.

Exceptions

| | |
|---------------------------|-------------------------|
| <i>FormattedException</i> | Failed to read a float. |
|---------------------------|-------------------------|

5.10.3.9 ReadFromFile()

```
void mage::BinaryReader::ReadFromFile (
    const wstring & fname,
    bool big_endian )
```

Reads from the given file.

Parameters

| | | |
|-----------------|-------------------------|---|
| <code>in</code> | <code>fname</code> | A reference to the file name. |
| <code>in</code> | <code>big_endian</code> | Flag indicating whether the given byte array should be interpreted as big endian or not (i.e. little endian). |
| | | Generated by Doxygen |

Exceptions

| | |
|---------------------------|-------------------------------------|
| <i>FormattedException</i> | Failed to read from the given file. |
|---------------------------|-------------------------------------|

5.10.3.10 ReadFromMemory()

```
void mage::BinaryReader::ReadFromMemory (
    const uint8_t * input,
    size_t size,
    bool big_endian )
```

Reads the input string.

Precondition

input is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|---|
| in | <i>input</i> | A pointer to the input byte string. |
| in | <i>size</i> | The size of the input string. |
| in | <i>big_endian</i> | Flag indicating whether the given byte array should be interpreted as big endian or not (i.e. little endian). |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read from the given input string. |
|---------------------------|---|

5.10.3.11 ReadInt16()

```
int16_t mage::BinaryReader::ReadInt16 ( ) [protected]
```

Reads a `int16_t`.

Returns

The `int16_t` read.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a <code>int16_t</code> . |
|---------------------------|---|

5.10.3.12 ReadInt32()

```
int32_t mage::BinaryReader::ReadInt32 ( ) [protected]
```

Reads a `int32_t`.

Returns

The `int32_t` read.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a <code>int32_t</code> . |
|---------------------------|---|

5.10.3.13 ReadInt64()

```
int64_t mage::BinaryReader::ReadInt64 ( ) [protected]
```

Reads a `int64_t`.

Returns

The `int64_t` read.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a <code>int64_t</code> . |
|---------------------------|---|

5.10.3.14 ReadInt8()

```
int8_t mage::BinaryReader::ReadInt8 ( ) [protected]
```

Reads a `int8_t`.

Returns

The `int8_t` read.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a <code>int8_t</code> . |
|---------------------------|--|

5.10.3.15 ReadUInt16()

```
uint16_t mage::BinaryReader::ReadUInt16 ( ) [protected]
```

Reads a `uint16_t`.

Returns

The `uint16_t` read.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a <code>uint16_t</code> . |
|---------------------------|--|

5.10.3.16 ReadUInt32()

```
uint32_t mage::BinaryReader::ReadUInt32 () [protected]
```

Reads a `uint32_t`.

Returns

The `uint32_t` read.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a <code>uint32_t</code> . |
|---------------------------|--|

5.10.3.17 ReadUInt64()

```
uint64_t mage::BinaryReader::ReadUInt64 () [protected]
```

Reads a `uint64_t`.

Returns

The `uint64_t` read.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a <code>uint64_t</code> . |
|---------------------------|--|

5.10.3.18 ReadUInt8()

```
uint8_t mage::BinaryReader::ReadUInt8 () [protected]
```

Reads a `uint8_t`.

Returns

The `uint8_t` read.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a <code>uint8_t</code> . |
|---------------------------|---|

5.10.4 Member Data Documentation

5.10.4.1 m_big_endian

```
bool mage::BinaryReader::m_big_endian [private]
```

A flag indicating whether the current data of this binary reader should be interpreted as big endian or not (i.e. little endian).

5.10.4.2 m_data

```
UniquePtr< uint8_t[] > mage::BinaryReader::m_data [private]
```

A pointer to the data to read of this binary reader.

5.10.4.3 m_end

```
const uint8_t* mage::BinaryReader::m_end [private]
```

A pointer to the end position of this binary reader.

5.10.4.4 m_fname

```
wstring mage::BinaryReader::m_fname [private]
```

The current filename of this line reader.

5.10.4.5 m_pos

```
const uint8_t* mage::BinaryReader::m_pos [private]
```

A pointer to the current position of this binary reader.

5.11 mage::BS Struct Reference

```
#include <bounding_volume.hpp>
```

Public Member Functions

- `BS ()`
- `BS (const Point3 &p)`
- `BS (const Point3 &p, float r)`
- `BS (const AABB &aabb)`
- `BS (const BS &bs)=default`
- `BS (BS &&bs)=default`
- `~BS ()=default`
- `BS & operator= (const BS &bs)=default`
- `BS & operator= (BS &&bs)=default`
- `bool Encloses (const Point3 &point) const`
- `bool EnclosesStrict (const Point3 &point) const`
- `bool Encloses (const AABB &aabb) const`
- `bool EnclosesStrict (const AABB &aabb) const`
- `bool Encloses (const BS &bs) const`
- `bool EnclosesStrict (const BS &bs) const`
- `bool EnclosedBy (const XMFLOAT4 *planes, size_t nb_planes) const`
- `bool EnclosedStrictBy (const XMFLOAT4 *planes, size_t nb_planes) const`
- `const Point3 Centroid () const`

Public Attributes

- `Point3 m_p`
- `float m_r`

5.11.1 Detailed Description

A struct of Bounding Spheres (`BS`).

5.11.2 Constructor & Destructor Documentation

5.11.2.1 `BS()` [1/6]

```
mage::BS::BS ( )
```

Constructs a `BS`.

5.11.2.2 `BS()` [2/6]

```
mage::BS::BS (
    const Point3 & p ) [explicit]
```

Constructs a `BS` of the given point.

Parameters

| | | |
|----|----------------|---------------------------|
| in | <code>p</code> | A reference to the point. |
|----|----------------|---------------------------|

5.11.2.3 **BS()** [3/6]

```
mage::BS::BS (
    const Point3 & p,
    float r ) [explicit]
```

Constructs a **BS**.

Parameters

| | | |
|----|----------|------------------------------|
| in | <i>p</i> | A reference to the position. |
| in | <i>r</i> | The radius. |

5.11.2.4 **BS()** [4/6]

```
mage::BS::BS (
    const AABB & aabb ) [explicit]
```

Constructs a **BS** from the given **AABB**.

Parameters

| | | |
|----|-------------|--------------------------|
| in | <i>aabb</i> | A reference to the aabb. |
|----|-------------|--------------------------|

5.11.2.5 **BS()** [5/6]

```
mage::BS::BS (
    const BS & bs ) [default]
```

Constructs a **BS** from the given **BS**.

Parameters

| | | |
|----|-----------|------------------------|
| in | <i>bs</i> | A reference to the bs. |
|----|-----------|------------------------|

5.11.2.6 **BS()** [6/6]

```
mage::BS::BS (
    BS && bs ) [default]
```

Constructs a **BS** from the given **BS**.

Parameters

| | | |
|----|-----------|------------------------|
| in | <i>bs</i> | A reference to the bs. |
|----|-----------|------------------------|

5.11.2.7 ~BS()

```
mage::BS::~BS ( ) [default]
```

Destructs this [BS](#).

5.11.3 Member Function Documentation

5.11.3.1 Centroid()

```
const Point3 mage::BS::Centroid ( ) const
```

Returns the centroid of this [AABB](#).

Returns

The centroid of this [AABB](#).

5.11.3.2 EnclosedBy()

```
bool mage::BS::EnclosedBy (
    const XMFLOAT4 * planes,
    size_t nb_planes ) const
```

Checks whether this [BS](#) completely encloses the given (closed) volume.

Precondition

planes is not equal to `nullptr`.
planes must point to an array of at least *nb_planes* planes.

Parameters

| | | |
|----|------------------|--|
| in | <i>planes</i> | A pointer to the planes of the volume. (each plane's coefficients are represented as a <code>XMFLOAT4</code>) |
| in | <i>nb_planes</i> | The number of planes. |

Returns

`true` if this [BS](#) completely encloses *planes*. `false` otherwise.

5.11.3.3 EnclosedStrictBy()

```
bool mage::BS::EnclosedStrictBy (
    const XMFLOAT4 * planes,
    size_t nb_planes ) const
```

Checks whether this [BS](#) completely, strictly encloses the given (closed) volume.

Precondition

planes is not equal to `nullptr`.
planes must point to an array of at least `nb_planes` planes.

Parameters

| | | |
|----|------------------|--|
| in | <i>planes</i> | A pointer to the planes of the volume. (each plane's coefficients are represented as a <code>XMFLOAT4</code>) |
| in | <i>nb_planes</i> | The number of planes. |

Returns

true if this [BS](#) completely, strictly encloses *planes*. false otherwise.

5.11.3.4 Encloses() [1/3]

```
bool mage::BS::Encloses (
    const Point3 & point ) const
```

Checks whether this [BS](#) completely encloses the given point.

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>point</i> | A reference to the point. |
|----|--------------|---------------------------|

Returns

true if this [BS](#) completely encloses *point*. false otherwise.

5.11.3.5 Encloses() [2/3]

```
bool mage::BS::Encloses (
    const AABB & aabb ) const
```

Checks whether this [BS](#) completely encloses the given [AABB](#).

Parameters

| | | |
|----|-------------|---|
| in | <i>aabb</i> | A reference to the AABB . |
|----|-------------|---|

Returns

true if this [BS](#) completely encloses *aabb*. false otherwise.

5.11.3.6 Encloses() [3/3]

```
bool mage::BS::Encloses (
    const BS & bs ) const
```

Checks whether this **BS** completely encloses the given **BS**.

Parameters

| | | |
|----|-----------|--------------------------------|
| in | <i>bs</i> | A reference to the BS . |
|----|-----------|--------------------------------|

Returns

true if this **BS** completely encloses *bs*. false otherwise.

5.11.3.7 EnclosesStrict() [1/3]

```
bool mage::BS::EnclosesStrict (
    const Point3 & point ) const
```

Checks whether this **BS** completely, strictly encloses the given point.

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>point</i> | A reference to the point. |
|----|--------------|---------------------------|

Returns

true if this **BS** completely, strictly encloses *point*. false otherwise.

5.11.3.8 EnclosesStrict() [2/3]

```
bool mage::BS::EnclosesStrict (
    const AABB & aabb ) const
```

Checks whether this **BS** completely, strictly encloses the given **AABB**.

Parameters

| | | |
|----|-------------|----------------------------------|
| in | <i>aabb</i> | A reference to the AABB . |
|----|-------------|----------------------------------|

Returns

true if this **BS** completely, strictly encloses *aabb*. false otherwise.

5.11.3.9 EnclosesStrict() [3/3]

```
bool mage::BS::EnclosesStrict (
    const BS & bs ) const
```

Checks whether this **BS** completely, strictly encloses the given **BS**.

Parameters

| | | |
|----|----|------------------------|
| in | bs | A reference to the BS. |
|----|----|------------------------|

Returns

true if this BS completely, strictly encloses bs. false otherwise.

5.11.3.10 operator=() [1/2]

```
BS& mage::BS::operator= (
    const BS & bs ) [default]
```

Copies the given BS to this BS.

Parameters

| | | |
|----|----|-------------------------------------|
| in | bs | A reference to the BS to copy from. |
|----|----|-------------------------------------|

Returns

A reference to the copy of the given BS (i.e. this BS).

5.11.3.11 operator=() [2/2]

```
BS& mage::BS::operator= (
    BS && bs ) [default]
```

Copies the given BS to this BS.

Parameters

| | | |
|----|----|-------------------------------------|
| in | bs | A reference to the BS to copy from. |
|----|----|-------------------------------------|

Returns

A reference to the copy of the given BS (i.e. this BS).

5.11.4 Member Data Documentation**5.11.4.1 m_p**

```
Point3 mage::BS::m_p
```

The position of this BS.

5.11.4.2 m_r

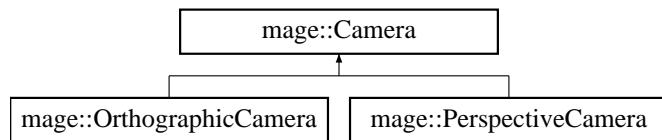
```
float mage::BS::m_r
```

The radius of this BS.

5.12 mage::Camera Class Reference

```
#include <camera.hpp>
```

Inheritance diagram for mage::Camera:



Public Member Functions

- virtual ~Camera ()
- Camera & operator= (const Camera &camera)
- Camera & operator= (Camera &&camera)
- UniquePtr< Camera > Clone () const
- float GetNearZ () const
- Camera & SetNearZ (float near_z)
- float GetFarZ () const
- Camera & SetFarZ (float far_z)
- Camera & SetNearAndFarZ (float near_z, float far_z)
- virtual XMMATRIX GetViewToProjectionMatrix () const =0

Protected Member Functions

- Camera (float near_z=MAGE_DEFAULT_CAMERA_NEAR_Z, float far_z=MAGE_DEFAULT_CAMERA_FAR_Z)
- Camera (const Camera &camera)
- Camera (Camera &&camera)

Private Member Functions

- virtual UniquePtr< Camera > CloneImplementation () const =0

Private Attributes

- float m_near_z
- float m_far_z

5.12.1 Detailed Description

A class of cameras.

5.12.2 Constructor & Destructor Documentation

5.12.2.1 ~Camera()

```
mage::Camera::~Camera ( ) [virtual], [default]
```

Destructs this camera.

5.12.2.2 Camera() [1/3]

```
mage::Camera::Camera (
    float near_z = MAGE_DEFAULT_CAMERA_NEAR_Z,
    float far_z = MAGE_DEFAULT_CAMERA_FAR_Z ) [explicit], [protected]
```

Constructs a camera.

Parameters

| | | |
|----|---------------|---|
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
| in | <i>far_z</i> | The position of the far z-plane in camera space. |

5.12.2.3 Camera() [2/3]

```
mage::Camera::Camera (
    const Camera & camera ) [protected], [default]
```

Constructs a camera from the given camera.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>camera</i> | A reference to the camera to copy. |
|----|---------------|------------------------------------|

5.12.2.4 Camera() [3/3]

```
mage::Camera::Camera (
    Camera && camera ) [protected], [default]
```

Constructs a camera by moving the given camera.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>camera</i> | A reference to the camera to move. |
|----|---------------|------------------------------------|

5.12.3 Member Function Documentation

5.12.3.1 Clone()

```
UniquePtr< Camera > mage::Camera::Clone ( ) const  
Clones this camera.
```

Returns

A pointer to the clone of this camera.

5.12.3.2 CloneImplementation()

```
virtual UniquePtr< Camera > mage::Camera::CloneImplementation ( ) const [private], [pure  
virtual]
```

Clones this camera.

Returns

A pointer to the clone of this camera.

Implemented in [mage::PerspectiveCamera](#), and [mage::OrthographicCamera](#).

5.12.3.3 GetFarZ()

```
float mage::Camera::GetFarZ ( ) const  
Returns the position of the far z-plane of this camera in camera space.
```

Returns

The position of the far z-plane of this camera.

5.12.3.4 GetNearZ()

```
float mage::Camera::GetNearZ ( ) const  
Returns the position of the near z-plane of this camera in camera space.
```

Returns

The position of the near z-plane of this camera.

5.12.3.5 GetViewToProjectionMatrix()

```
virtual XMATRIX mage::Camera::GetViewToProjectionMatrix ( ) const [pure virtual]  
Returns the view-to-projection matrix of this camera.
```

Returns

The view-to-projection matrix of this camera.

Implemented in [mage::PerspectiveCamera](#), and [mage::OrthographicCamera](#).

5.12.3.6 operator=() [1/2]

```
Camera & mage::Camera::operator= (const Camera & camera) [default]
```

Copies the given camera to this camera.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>camera</i> | A reference to the camera to copy. |
|----|---------------|------------------------------------|

Returns

A reference to the copy of the given camera (i.e. this camera).

5.12.3.7 operator=() [2/2]

```
Camera & mage::Camera::operator= (
    Camera && camera ) [default]
```

Moves the given camera to this camera.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>camera</i> | A reference to the camera to move. |
|----|---------------|------------------------------------|

Returns

A reference to the moved camera (i.e. this camera).

5.12.3.8 SetFarZ()

```
Camera& mage::Camera::SetFarZ (
    float far_z )
```

Sets the position of the far z-plane of this camera to the given value.

Parameters

| | | |
|----|--------------|--|
| in | <i>far_z</i> | The position of the far z-plane in camera space. |
|----|--------------|--|

Returns

A reference to this camera in camera space.

5.12.3.9 SetNearAndFarZ()

```
Camera& mage::Camera::SetNearAndFarZ (
    float near_z,
    float far_z )
```

Sets the position of the near and far z-plane of this camera to the given values.

Parameters

| | | |
|----|---------------|---|
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
| in | <i>far_z</i> | The position of the far z-plane in camera space. |

Returns

A reference to this camera.

5.12.3.10 SetNearZ()

```
Camera& mage::Camera::SetNearZ (
    float near_z )
```

Sets the position of the near z-plane of this camera to the given value.

Parameters

| | | |
|----|---------------|---|
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
|----|---------------|---|

Returns

A reference to this camera in camera space.

5.12.4 Member Data Documentation**5.12.4.1 m_far_z**

```
float mage::Camera::m_far_z [private]
```

The position of the far z-plane of this camera in camera space.

5.12.4.2 m_near_z

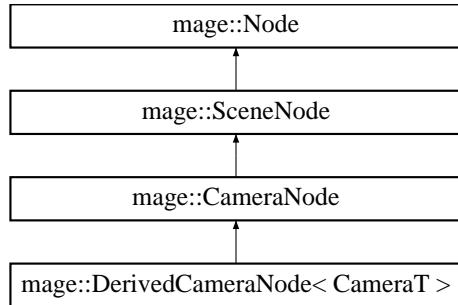
```
float mage::Camera::m_near_z [private]
```

The position of the near z-plane of this camera in camera space.

5.13 mage::CameraNode Class Reference

```
#include <camera_node.hpp>
```

Inheritance diagram for mage::CameraNode:



Public Member Functions

- virtual ~CameraNode ()
- CameraNode & operator= (const CameraNode &camera_node)=delete
- CameraNode & operator= (CameraNode &&camera_node)=delete
- UniquePtr< CameraNode > Clone () const
- Camera * GetCamera ()
- const Camera * GetCamera () const

Protected Member Functions

- CameraNode (const string &name, UniquePtr< Camera > &&camera)
- CameraNode (const CameraNode &camera_node)
- CameraNode (CameraNode &&camera_node)

Private Member Functions

- virtual UniquePtr< Node > CloneImplementation () const override=0

Private Attributes

- UniquePtr< Camera > m_camera

5.13.1 Constructor & Destructor Documentation

5.13.1.1 ~CameraNode()

```
mage::CameraNode::~CameraNode ( ) [virtual], [default]
```

5.13.1.2 CameraNode() [1/3]

```
mage::CameraNode::CameraNode (
    const string & name,
    UniquePtr< Camera > && camera ) [explicit], [protected]
```

5.13.1.3 CameraNode() [2/3]

```
mage::CameraNode::CameraNode (
    const CameraNode & camera_node ) [protected]
```

5.13.1.4 CameraNode() [3/3]

```
mage::CameraNode::CameraNode (
    CameraNode && camera_node ) [protected], [default]
```

5.13.2 Member Function Documentation

5.13.2.1 Clone()

```
UniquePtr< CameraNode > mage::CameraNode::Clone () const
```

5.13.2.2 ClonelImplementation()

```
virtual UniquePtr< Node > mage::CameraNode::ClonelImplementation () const [override], [private], [pure virtual]
```

Clones this node.

Returns

A pointer to the clone of this node.

Reimplemented from [mage::SceneNode](#).

Implemented in [mage::DerivedCameraNode< CameraT >](#).

5.13.2.3 GetCamera() [1/2]

```
Camera* mage::CameraNode::GetCamera ()
```

5.13.2.4 GetCamera() [2/2]

```
const Camera* mage::CameraNode::GetCamera () const
```

5.13.2.5 operator=() [1/2]

```
CameraNode& mage::CameraNode::operator= (
    const CameraNode & camera_node ) [delete]
```

5.13.2.6 operator=() [2/2]

```
CameraNode& mage::CameraNode::operator= (
    CameraNode && camera_node ) [delete]
```

5.13.3 Member Data Documentation

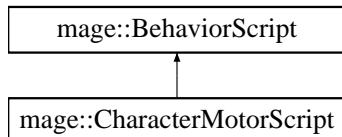
5.13.3.1 m_camera

```
UniquePtr< Camera > mage::CameraNode::m_camera [private]
```

5.14 mage::CharacterMotorScript Class Reference

```
#include <character_motor_script.hpp>
```

Inheritance diagram for mage::CharacterMotorScript:



Public Member Functions

- [CharacterMotorScript \(TransformNode *transform\)](#)
- [CharacterMotorScript \(const CharacterMotorScript &script\)=delete](#)
- [CharacterMotorScript \(CharacterMotorScript &&script\)](#)
- [virtual ~CharacterMotorScript \(\)](#)
- [CharacterMotorScript & operator= \(const CharacterMotorScript &script\)=delete](#)
- [CharacterMotorScript & operator= \(CharacterMotorScript &&script\)=delete](#)
- [virtual void Update \(double delta_time\) override](#)
- [float GetVelocity \(\) const](#)
- [void SetVelocity \(float velocity\)](#)

Private Attributes

- [TransformNode *const m_transform](#)
- [float m_velocity](#)

Additional Inherited Members

5.14.1 Constructor & Destructor Documentation

5.14.1.1 CharacterMotorScript() [1/3]

```
mage::CharacterMotorScript::CharacterMotorScript (
    TransformNode * transform ) [explicit]
```

5.14.1.2 CharacterMotorScript() [2/3]

```
mage::CharacterMotorScript::CharacterMotorScript (
    const CharacterMotorScript & script ) [delete]
```

5.14.1.3 CharacterMotorScript() [3/3]

```
mage::CharacterMotorScript::CharacterMotorScript (
    CharacterMotorScript && script ) [default]
```

5.14.1.4 ~CharacterMotorScript()

```
mage::CharacterMotorScript::~CharacterMotorScript () [virtual], [default]
```

5.14.2 Member Function Documentation

5.14.2.1 GetVelocity()

```
float mage::CharacterMotorScript::GetVelocity () const
```

5.14.2.2 operator=() [1/2]

```
CharacterMotorScript& mage::CharacterMotorScript::operator= (
    const CharacterMotorScript & script ) [delete]
```

5.14.2.3 operator=() [2/2]

```
CharacterMotorScript& mage::CharacterMotorScript::operator= (
    CharacterMotorScript && script ) [delete]
```

5.14.2.4 SetVelocity()

```
void mage::CharacterMotorScript::SetVelocity (
    float velocity )
```

5.14.2.5 Update()

```
void mage::CharacterMotorScript::Update (
    double delta_time ) [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.14.3 Member Data Documentation

5.14.3.1 m_transform

```
TransformNode* const mage::CharacterMotorScript::m_transform [private]
```

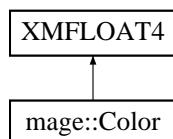
5.14.3.2 m_velocity

```
float mage::CharacterMotorScript::m_velocity [private]
```

5.15 mage::Color Struct Reference

```
#include <math.hpp>
```

Inheritance diagram for mage::Color:



Public Member Functions

- [Color \(\)](#)
- [Color \(float x, float y, float z, float w\)](#)
- [Color \(const Color &color\)](#)
- [Color \(Color &&color\)](#)
- [Color \(const XMFLOAT4 &v\)](#)
- [Color \(XMFLOAT4 &&v\)](#)
- [~Color \(\)=default](#)
- [Color & operator= \(const Color &color\)](#)
- [Color & operator= \(Color &&color\)](#)

5.15.1 Detailed Description

A struct of colors.

5.15.2 Constructor & Destructor Documentation

5.15.2.1 Color() [1/6]

```
mage::Color::Color ( )
```

Constructs a color.

5.15.2.2 Color() [2/6]

```
mage::Color::Color (
    float x,
    float y,
    float z,
    float w )
```

Constructs a color from the given components.

Parameters

| | | |
|----|---|-----------------------|
| in | x | The first component. |
| in | y | The second component. |
| in | z | The third component. |
| in | w | The fourth component. |

5.15.2.3 Color() [3/6]

```
mage::Color::Color (
    const Color & color )
```

Constructs a color from the given color.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | color | A reference to the color to copy. |
|----|-------|-----------------------------------|

5.15.2.4 Color() [4/6]

```
mage::Color::Color (
    Color && color )
```

Constructs a color by moving the given color.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | color | A reference to the color to move. |
|----|-------|-----------------------------------|

5.15.2.5 Color() [5/6]

```
mage::Color::Color (
    const XMFLOAT4 & v ) [explicit]
```

Constructs a color from the given vector.

Parameters

| | | |
|----|---|------------------------------------|
| in | v | A reference to the vector to copy. |
|----|---|------------------------------------|

5.15.2.6 Color() [6/6]

```
mage::Color::Color (
    XMFLOAT4 && v ) [explicit]
```

Constructs a color by moving the given vector.

Parameters

| | | |
|----|---|------------------------------------|
| in | v | A reference to the vector to move. |
|----|---|------------------------------------|

5.15.2.7 ~Color()

```
mage::Color::~Color ( ) [default]
```

Destructs this color.

5.15.3 Member Function Documentation

5.15.3.1 operator=() [1/2]

```
Color& mage::Color::operator= (
    const Color & color )
```

Copies the given color to this color.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | color | A reference to the color to copy. |
|----|-------|-----------------------------------|

Returns

A reference to the copy of the given color (i.e. this color).

5.15.3.2 operator=() [2/2]

```
Color& mage::Color::operator= (
    Color && color )
```

Moves the given color to this color.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | color | A reference to the color to move. |
|----|-------|-----------------------------------|

Returns

A reference to the moved color (i.e. this color).

5.16 mage::ColorString Struct Reference

```
#include <color_string.hpp>
```

Public Member Functions

- `ColorString (const wstring &str, const Color &color)`
- `ColorString (const wstring &str, const XMVECTOR &color=Colors::White)`
- `ColorString (const wchar_t *str, const Color &color)`
- `ColorString (const wchar_t *str, const XMVECTOR &color=Colors::White)`
- `ColorString (const ColorString &color_string)=default`
- `ColorString (ColorString &&color_string)=default`
- `~ColorString ()=default`
- `ColorString & operator= (const ColorString &color_string)=default`
- `ColorString & operator= (ColorString &&color_string)=default`
- `const wchar_t * c_str () const`
- `const wstring & GetString () const`
- `void SetString (const wstring &str)`
- `void SetString (const wchar_t *str)`
- `const Color GetColor () const`
- `const XMVECTOR GetColorVector () const`
- `void SetColor (const Color &color)`
- `void SetColor (const XMVECTOR &color)`

Private Attributes

- `wstring m_str`
- `Color m_color`

5.16.1 Detailed Description

A struct of color strings representing a string and its color.

5.16.2 Constructor & Destructor Documentation

5.16.2.1 ColorString() [1/6]

```
mage::ColorString::ColorString (
    const wstring & str,
    const Color & color ) [explicit]
```

Constructs a color string fromt the given string and color.

Parameters

| | | |
|----|--------------|----------------------------|
| in | <i>str</i> | A reference to the string. |
| in | <i>color</i> | A reference to the color. |

5.16.2.2 ColorString() [2/6]

```
mage::ColorString::ColorString (
    const wstring & str,
    const XMVECTOR & color = Colors::White ) [explicit]
```

Constructs a color string fromt the given string and color.

Parameters

| | | |
|----|--------------|----------------------------|
| in | <i>str</i> | A reference to the string. |
| in | <i>color</i> | A reference to the color. |

5.16.2.3 ColorString() [3/6]

```
mage::ColorString::ColorString (
    const wchar_t * str,
    const Color & color ) [explicit]
```

Constructs a color string fromt the given string and color.

Precondition

str is not equal to nullptr.

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>str</i> | A pointer to the string. |
| in | <i>color</i> | A reference to the color. |

5.16.2.4 ColorString() [4/6]

```
mage::ColorString::ColorString (
    const wchar_t * str,
    const XMVECTOR & color = Colors::White ) [explicit]
```

Constructs a color string fromt the given str and color.

Precondition

str is not equal to nullptr.

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>str</i> | A pointer to the str. |
| in | <i>color</i> | A reference to the color. |

5.16.2.5 ColorString() [5/6]

```
mage::ColorString::ColorString (
    const ColorString & color_string ) [default]
```

Constructs a color string from the given color string.

Parameters

| | | |
|----|---------------------|--|
| in | <i>color_string</i> | A reference to the color string to copy. |
|----|---------------------|--|

5.16.2.6 ColorString() [6/6]

```
mage::ColorString::ColorString (
    ColorString && color_string ) [default]
```

Constructs a color string by moving the given color string.

Parameters

| | | |
|----|---------------------|--|
| in | <i>color_string</i> | A reference to the color string to move. |
|----|---------------------|--|

5.16.2.7 ~ColorString()

```
mage::ColorString::~ColorString ( ) [default]
```

Destructs this color string.

5.16.3 Member Function Documentation

5.16.3.1 c_str()

```
const wchar_t* mage::ColorString::c_str ( ) const
```

Returns the string of this color string.

Returns

A pointer to the string of this color string.

5.16.3.2 GetColor()

```
const Color mage::ColorString::GetColor ( ) const
```

Returns the color of this color string.

Returns

The color of this color string.

5.16.3.3 GetColorVector()

```
const XMVECTOR mage::ColorString::GetColorVector ( ) const
```

Returns the color of this color string as XMVECTOR.

Returns

The color of this color string as XMVECTOR.

5.16.3.4 GetString()

```
const wstring& mage::ColorString::GetString ( ) const
```

Returns the string of this color string.

Returns

A reference to the string of this color string.

5.16.3.5 operator=() [1/2]

```
ColorString& mage::ColorString::operator= (
    const ColorString & color_string ) [default]
```

Copies the given color string to this color string.

Parameters

| | | |
|----|---------------------|--|
| in | <i>color_string</i> | A reference to the color string to copy. |
|----|---------------------|--|

Returns

A reference to the copy of the given color string (i.e. this color string).

5.16.3.6 operator=() [2/2]

```
ColorString& mage::ColorString::operator= (
    ColorString && color_string ) [default]
```

Moves the given color string to this color string.

Parameters

| | | |
|----|---------------------|--|
| in | <i>color_string</i> | A reference to the color string to move. |
|----|---------------------|--|

Returns

A reference to the moved color string (i.e. this color string).

5.16.3.7 SetColor() [1/2]

```
void mage::ColorString::SetColor (
    const Color & color )
```

Sets the color of this color string to the given color.

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>color</i> | A reference to the color. |
|----|--------------|---------------------------|

5.16.3.8 SetColor() [2/2]

```
void mage::ColorString::SetColor (
    const XMVECTOR & color )
```

Sets the color of this color string to the given color.

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>color</i> | A reference to the color. |
|----|--------------|---------------------------|

5.16.3.9 SetString() [1/2]

```
void mage::ColorString::SetString (
    const wstring & str )
```

Sets the string of this color string to the given str.

Parameters

| | | |
|----|-----|----------------------------|
| in | str | A reference to the string. |
|----|-----|----------------------------|

5.16.3.10 SetString() [2/2]

```
void mage::ColorString::SetString (
    const wchar_t * str )
```

Sets the string of this color string to the given str.

Precondition

str is not equal to nullptr.

Parameters

| | | |
|----|-----|--------------------------|
| in | str | A pointer to the string. |
|----|-----|--------------------------|

5.16.4 Member Data Documentation

5.16.4.1 m_color

`Color` `mage::ColorString::m_color` [private]

The color of this color string.

5.16.4.2 m_str

`wstring` `mage::ColorString::m_str` [private]

The string of this color string.

5.17 mage::CombinedShader Struct Reference

```
#include <shader.hpp>
```

Public Member Functions

- `CombinedShader (SharedPtr< VertexShader > vertex_shader, SharedPtr< PixelShader > pixel_shader)`
- `CombinedShader (const CombinedShader &shader)=default`
- `CombinedShader (CombinedShader &&shader)=default`
- `~CombinedShader ()=default`
- `CombinedShader & operator= (const CombinedShader &shader)=default`
- `CombinedShader & operator= (CombinedShader &&shader)=default`
- `void PrepareShading (ID3D11Buffer *transform, ID3D11ShaderResourceView *texture) const`
- `void PrepareShading (ID3D11Buffer *transform, const Material &material, const Lighting &lighting) const`

Private Attributes

- `SharedPtr< VertexShader > m_vertex_shader`
- `SharedPtr< PixelShader > m_pixel_shader`

5.17.1 Detailed Description

A struct of combined (vertex and pixel) shaders.

5.17.2 Constructor & Destructor Documentation

5.17.2.1 CombinedShader() [1/3]

```
mage::CombinedShader::CombinedShader (
    SharedPtr< VertexShader > vertex_shader,
    SharedPtr< PixelShader > pixel_shader ) [explicit]
```

Constructs a combined shader.

Precondition

`vertex_shader.get ()` is not equal to `nullptr`.
`pixel_shader.get ()` is not equal to `nullptr`.

Parameters

| | | |
|----|----------------------------|---------------------------------|
| in | <code>vertex_shader</code> | A pointer to the vertex shader. |
| in | <code>pixel_shader</code> | A pointer to the pixel shader. |

5.17.2.2 CombinedShader() [2/3]

```
mage::CombinedShader::CombinedShader (
    const CombinedShader & shader ) [default]
```

Constructs a combined shader from the given combined shader.

Parameters

| | | |
|----|---------------------|---|
| in | <code>shader</code> | A reference to the combined shader to copy. |
|----|---------------------|---|

5.17.2.3 CombinedShader() [3/3]

```
mage::CombinedShader::CombinedShader (
    CombinedShader && shader ) [default]
```

Constructs a combined shader by moving the given combined shader.

Parameters

| | | |
|----|---------------------|---|
| in | <code>shader</code> | A reference to the combined shader to move. |
|----|---------------------|---|

5.17.2.4 ~CombinedShader()

```
mage::CombinedShader::~CombinedShader () [default]
```

Destructs this combined shader.

5.17.3 Member Function Documentation**5.17.3.1 operator=() [1/2]**

```
CombinedShader& mage::CombinedShader::operator= (
    const CombinedShader & shader ) [default]
```

Copies the given combined shader to this combined shader.

Parameters

| | | |
|----|---------------------|---|
| in | <code>shader</code> | A reference to the combined shader to copy. |
|----|---------------------|---|

Returns

A reference to the copy of the given combined shader (i.e. this combined shader).

5.17.3.2 operator=() [2/2]

```
CombinedShader& mage::CombinedShader::operator= (
    CombinedShader && shader ) [default]
```

Moves the given combined shader to this combined shader.

Parameters

| | | |
|-----------------|---------------------|---|
| <code>in</code> | <code>shader</code> | A reference to the combined shader to move. |
|-----------------|---------------------|---|

Returns

A reference to the moved combined shader (i.e. this combined shader).

5.17.3.3 PrepareShading() [1/2]

```
void mage::CombinedShader::PrepareShading (
    ID3D11Buffer * transform,
    ID3D11ShaderResourceView * texture ) const
```

Prepares this combined shader for shading.

Precondition

transform is not equal to `nullptr`.
texture is not equal to `nullptr`.

Parameters

| | | |
|-----------------|------------------------|--|
| <code>in</code> | <code>transform</code> | A pointer to the transform buffer. |
| <code>in</code> | <code>texture</code> | A pointer to the texture shader resource view. |

5.17.3.4 PrepareShading() [2/2]

```
void mage::CombinedShader::PrepareShading (
    ID3D11Buffer * transform,
    const Material & material,
    const Lighting & lighting ) const
```

Prepares this combined shader for shading.

Precondition

transform is not equal to `nullptr`.

Parameters

| | | |
|-----------------|------------------------|-------------------------------------|
| <code>in</code> | <code>transform</code> | A pointer to the transform buffer. |
| <code>in</code> | <code>material</code> | A reference to the material. |
| <code>in</code> | <code>lighting</code> | A reference to the lighting buffer. |

5.17.4 Member Data Documentation

5.17.4.1 m_pixel_shader

```
SharedPtr< PixelShader > mage::CombinedShader::m_pixel_shader [private]
```

A pointer to the pixel shader of this combined shader.

5.17.4.2 m_vertex_shader

```
SharedPtr< VertexShader > mage::CombinedShader::m_vertex_shader [private]
```

A pointer to the vertex shader of this combined shader.

5.18 mage::CompiledPixelShader Struct Reference

```
#include <compiled_shader.hpp>
```

Public Member Functions

- `CompiledPixelShader (const wstring &name, const BYTE *bytecode, SIZE_T bytecode_size)`
- `CompiledPixelShader (const CompiledPixelShader &compiled_pixel_shader)=default`
- `CompiledPixelShader (CompiledPixelShader &&compiled_pixel_shader)=default`
- `~CompiledPixelShader ()=default`
- `CompiledPixelShader & operator= (const CompiledPixelShader &compiled_pixel_shader)=delete`
- `CompiledPixelShader & operator= (CompiledPixelShader &&compiled_pixel_shader)=delete`

Public Attributes

- `const wstring m_name`
- `const BYTE *const m_bytecode`
- `const SIZE_T m_bytecode_size`

5.18.1 Detailed Description

A struct of compiled pixel shaders.

5.18.2 Constructor & Destructor Documentation

5.18.2.1 CompiledPixelShader() [1/3]

```
mage::CompiledPixelShader::CompiledPixelShader (
    const wstring & name,
    const BYTE * bytecode,
    SIZE_T bytecode_size ) [explicit]
```

Constructs a compiled shader.

Precondition

bytecode is not equal to `nullptr`.

The size of the data pointed to by *bytecode* is equal to *bytecode_size* (bytes).

Parameters

| | | |
|-----------------|----------------------------|--|
| <code>in</code> | <code>name</code> | A reference to the name of the shader. |
| <code>in</code> | <code>bytecode</code> | A pointer to the shader bytecode. |
| <code>in</code> | <code>bytecode_size</code> | The size of the given shader bytecode. |

5.18.2.2 CompiledPixelShader() [2/3]

```
mage::CompiledPixelShader::CompiledPixelShader (
    const CompiledPixelShader & compiled_pixel_shader ) [default]
```

Constructs a compiled pixel shader from the given compiled pixel shader.

Parameters

| | | |
|-----------------|------------------------------------|---|
| <code>in</code> | <code>compiled_pixel_shader</code> | A reference to the compiled pixel shader to copy. |
|-----------------|------------------------------------|---|

5.18.2.3 CompiledPixelShader() [3/3]

```
mage::CompiledPixelShader::CompiledPixelShader (
    CompiledPixelShader && compiled_pixel_shader ) [default]
```

Constructs a compiled pixel shader by moving the given compiled pixel shader.

Parameters

| | | |
|-----------------|------------------------------------|---|
| <code>in</code> | <code>compiled_pixel_shader</code> | A reference to the compiled pixel shader to move. |
|-----------------|------------------------------------|---|

5.18.2.4 ~CompiledPixelShader()

```
mage::CompiledPixelShader::~CompiledPixelShader ( ) [default]
```

Destructs this compiled pixel shader.

5.18.3 Member Function Documentation**5.18.3.1 operator=()** [1/2]

```
CompiledPixelShader& mage::CompiledPixelShader::operator= (
    const CompiledPixelShader & compiled_pixel_shader ) [delete]
```

Copies the given compiled pixel shader to this compiled pixel shader.

Parameters

| | | |
|-----------------|------------------------------------|---|
| <code>in</code> | <code>compiled_pixel_shader</code> | A reference to the compiled pixel shader to copy. |
|-----------------|------------------------------------|---|

Returns

A reference to the copy of the given compiled pixel shader (i.e. this compiled pixel shader).

5.18.3.2 operator=() [2/2]

```
CompiledPixelShader& mage::CompiledPixelShader::operator= (
    CompiledPixelShader && compiled_pixel_shader ) [delete]
```

Moves the given compiled pixel shader to this compiled pixel shader.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>compiled_pixel_shader</i> | A reference to the compiled pixel shader to copy. |
|----|------------------------------|---|

Returns

A reference to the moved compiled pixel shader (i.e. this compiled pixel shader).

5.18.4 Member Data Documentation**5.18.4.1 m_bytecode**

```
const BYTE* const mage::CompiledPixelShader::m_bytecode
```

A pointer to the bytecode of this compiled pixel shader.

5.18.4.2 m_bytecode_size

```
const SIZE_T mage::CompiledPixelShader::m_bytecode_size
```

The size of the bytecode of this compiled pixel shader.

5.18.4.3 m_name

```
const wstring mage::CompiledPixelShader::m_name
```

The name of this compiled pixel shader.

5.19 mage::CompiledVertexShader Struct Reference

```
#include <compiled_shader.hpp>
```

Public Member Functions

- `CompiledVertexShader` (const wstring &name, const BYTE *bytecode, SIZE_T bytecode_size)
- `CompiledVertexShader` (const `CompiledVertexShader` &compiled_vertex_shader)=default
- `CompiledVertexShader` (`CompiledVertexShader` &&compiled_vertex_shader)=default
- `~CompiledVertexShader` ()=default
- `CompiledVertexShader` & `operator=` (const `CompiledVertexShader` &compiled_vertex_shader)=delete
- `CompiledVertexShader` & `operator=` (`CompiledVertexShader` &&compiled_vertex_shader)=delete

Public Attributes

- const wstring `m_name`
- const BYTE *const `m_bytecode`
- const SIZE_T `m_bytecode_size`

5.19.1 Detailed Description

A struct of compiled vertex shaders.

5.19.2 Constructor & Destructor Documentation

5.19.2.1 `CompiledVertexShader()` [1/3]

```
mage::CompiledVertexShader::CompiledVertexShader (
    const wstring & name,
    const BYTE * bytecode,
    SIZE_T bytecode_size ) [explicit]
```

Constructs a compiled vertex shader.

Precondition

bytecode is not equal to `nullptr`.
 The size of the data pointed to by *bytecode* is equal to *bytecode_size* (bytes).

Parameters

| | | |
|----|----------------------|--|
| in | <i>name</i> | A reference to the name of the shader. |
| in | <i>bytecode</i> | A pointer to the shader bytecode. |
| in | <i>bytecode_size</i> | The size of the given shader bytecode. |

5.19.2.2 `CompiledVertexShader()` [2/3]

```
mage::CompiledVertexShader::CompiledVertexShader (
    const CompiledVertexShader & compiled_vertex_shader ) [default]
```

Constructs a compiled vertex shader from the given compiled vertex shader.

Parameters

| | | |
|----|-------------------------------------|--|
| in | <code>compiled_vertex_shader</code> | A reference to the compiled vertex shader to copy. |
|----|-------------------------------------|--|

5.19.2.3 CompiledVertexShader() [3/3]

```
mage::CompiledVertexShader::CompiledVertexShader (
    CompiledVertexShader && compiled_vertex_shader ) [default]
```

Constructs a compiled vertex shader by moving the given compiled vertex shader.

Parameters

| | | |
|----|-------------------------------------|--|
| in | <code>compiled_vertex_shader</code> | A reference to the compiled vertex shader to move. |
|----|-------------------------------------|--|

5.19.2.4 ~CompiledVertexShader()

```
mage::CompiledVertexShader::~CompiledVertexShader () [default]
```

Destructs this compiled vertex shader.

5.19.3 Member Function Documentation**5.19.3.1 operator=() [1/2]**

```
CompiledVertexShader& mage::CompiledVertexShader::operator= (
    const CompiledVertexShader & compiled_vertex_shader ) [delete]
```

Copies the given compiled vertex shader to this compiled vertex shader.

Parameters

| | | |
|----|-------------------------------------|--|
| in | <code>compiled_vertex_shader</code> | A reference to the compiled vertex shader to copy. |
|----|-------------------------------------|--|

Returns

A reference to the copy of the given compiled vertex shader (i.e. this compiled vertex shader).

5.19.3.2 operator=() [2/2]

```
CompiledVertexShader& mage::CompiledVertexShader::operator= (
    CompiledVertexShader && compiled_vertex_shader ) [delete]
```

Moves the given compiled vertex shader to this compiled vertex shader.

Parameters

| | | |
|-----------------|-------------------------------------|--|
| <code>in</code> | <code>compiled_vertex_shader</code> | A reference to the compiled vertex shader to copy. |
|-----------------|-------------------------------------|--|

Returns

A reference to the moved compiled vertex shader (i.e. this compiled vertex shader).

5.19.4 Member Data Documentation

5.19.4.1 m_bytecode

```
const BYTE* const mage::CompiledVertexShader::m_bytecode
```

A pointer to the bytecode of this compiled vertex shader.

5.19.4.2 m_bytecode_size

```
const SIZE_T mage::CompiledVertexShader::m_bytecode_size
```

The size of the bytecode of this compiled vertex shader.

5.19.4.3 m_name

```
const wstring mage::CompiledVertexShader::m_name
```

The name of this compiled vertex shader.

5.20 mage::ConditionVariable Struct Reference

```
#include <lock.hpp>
```

Public Member Functions

- [ConditionVariable \(\)](#)
- [ConditionVariable \(const ConditionVariable &condition_variable\)=delete](#)
- [ConditionVariable \(ConditionVariable &&condition_variable\)=default](#)
- [~ConditionVariable \(\)](#)
- [ConditionVariable & operator= \(const ConditionVariable &condition_variable\)=delete](#)
- [ConditionVariable & operator= \(ConditionVariable &&condition_variable\)=delete](#)
- [void Lock \(\)](#)
- [void Unlock \(\)](#)
- [void Signal \(\)](#)
- [void Wait \(\)](#)

Private Types

- enum { **SIGNAL** = 0, **BROADCAST** = 1, **NB_EVENTS** = 2 }

Private Attributes

- uint32_t **m_nb_waiters**
- CRITICAL_SECTION **m_nb_waiters_mutex**
- CRITICAL_SECTION **m_condition_mutex**
- HANDLE **m_events** [**NB_EVENTS**]

5.20.1 Detailed Description

A struct of condition variables.

5.20.2 Member Enumeration Documentation

5.20.2.1 anonymous enum

anonymous enum [private]

An enumeration of the different types of events of this condition variable.

Enumerator

| | |
|-----------|--|
| SIGNAL | |
| BROADCAST | |
| NB_EVENTS | |

5.20.3 Constructor & Destructor Documentation

5.20.3.1 ConditionVariable() [1/3]

mage::ConditionVariable::ConditionVariable ()

Constructs a condition variable.

5.20.3.2 ConditionVariable() [2/3]

mage::ConditionVariable::ConditionVariable (const **ConditionVariable** & *condition_variable*) [delete]

Constructs a condition variable from the given condition variable.

Parameters

| | | |
|----|---------------------------|--|
| in | <i>condition_variable</i> | A reference to the condition variable to copy. |
|----|---------------------------|--|

5.20.3.3 ConditionVariable() [3/3]

```
mage::ConditionVariable::ConditionVariable (
    ConditionVariable && condition_variable ) [default]
```

Constructs a condition variable by moving the given condition variable.

Parameters

| | | |
|----|---------------------------|--|
| in | <i>condition_variable</i> | A reference to the condition variable to move. |
|----|---------------------------|--|

5.20.3.4 ~ConditionVariable()

```
mage::ConditionVariable::~ConditionVariable ( )
```

Destructs this condition variable.

5.20.4 Member Function Documentation**5.20.4.1 Lock()**

```
void mage::ConditionVariable::Lock ( )
```

Locks this condition variable.

5.20.4.2 operator=() [1/2]

```
ConditionVariable& mage::ConditionVariable::operator=
    const ConditionVariable & condition_variable ) [delete]
```

Copies the given condition variable to this condition variable.

Parameters

| | | |
|----|---------------------------|--|
| in | <i>condition_variable</i> | A reference to the condition variable to copy. |
|----|---------------------------|--|

Returns

A reference to the copy of the given condition variable (i.e. this condition variable)

5.20.4.3 operator=() [2/2]

```
ConditionVariable& mage::ConditionVariable::operator= (
    ConditionVariable && condition_variable ) [delete]
```

Moves the given condition variable to this condition variable.

Parameters

| | | |
|----|---------------------------|--|
| in | <i>condition_variable</i> | A reference to the condition variable to move. |
|----|---------------------------|--|

Returns

A reference to the moved condition variable (i.e. this condition variable)

5.20.4.4 Signal()

```
void mage::ConditionVariable::Signal ( )
```

Signals a condition change.

5.20.4.5 Unlock()

```
void mage::ConditionVariable::Unlock ( )
```

Unlocks this condition variable.

5.20.4.6 Wait()

```
void mage::ConditionVariable::Wait ( )
```

Waits for a signal indicating a condition change.

5.20.5 Member Data Documentation

5.20.5.1 m_condition_mutex

```
CRITICAL_SECTION mage::ConditionVariable::m_condition_mutex [private]
```

The critical section object for the mutex guarding the condition of this condition variable.

5.20.5.2 m_events

```
HANDLE mage::ConditionVariable::m_events[NB_EVENTS] [private]
```

The signal and broadcast event handles of this condition variable.

5.20.5.3 m_nb_waiters

```
uint32_t mage::ConditionVariable::m_nb_waiters [private]
```

The number of waiters of this condition variable.

5.20.5.4 m_nb_waiters_mutex

```
CRITICAL_SECTION mage::ConditionVariable::m_nb_waiters_mutex [private]
```

The critical section object for the mutex guarding m_nb_waiters of this condition variable.

5.21 mage::ConstantBuffer< DataT > Struct Template Reference

```
#include <constant_buffer.hpp>
```

Public Member Functions

- [ConstantBuffer](#) (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context)
- [ConstantBuffer](#) (const [ConstantBuffer](#) &buffer)=delete
- [ConstantBuffer](#) ([ConstantBuffer](#) &&buffer)=default
- [~ConstantBuffer](#) ()=default
- [ConstantBuffer & operator=](#) (const [ConstantBuffer](#) &buffer)=delete
- [ConstantBuffer & operator=](#) ([ConstantBuffer](#) &&buffer)=delete
- void [UpdateData](#) (const DataT &data) const
- ID3D11Buffer * [Get](#) () const
- ID3D11Buffer *const * [GetAddressOf](#) () const
- ID3D11Buffer ** [GetAddressOf](#) ()

Private Member Functions

- void [SetupConstantBuffer](#) ()

Private Attributes

- ID3D11Device2 *const [m_device](#)
- ID3D11DeviceContext2 *const [m_device_context](#)
- ComPtr< ID3D11Buffer > [m_buffer](#)

5.21.1 Detailed Description

```
template<typename DataT>
struct mage::ConstantBuffer< DataT >
```

A class of constant buffers (for binding buffers to the rendering pipeline).

Template Parameters

| | |
|--------------|----------------|
| <i>DataT</i> | The data type. |
|--------------|----------------|

5.21.2 Constructor & Destructor Documentation**5.21.2.1 ConstantBuffer() [1/3]**

```
template<typename DataT>
mage::ConstantBuffer< DataT >::ConstantBuffer (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context ) [explicit]
```

Constructs a constant buffer.

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|----|-----------------------|----------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |

5.21.2.2 ConstantBuffer() [2/3]

```
template<typename DataT>
mage::ConstantBuffer< DataT >::ConstantBuffer (
    const ConstantBuffer< DataT > & buffer ) [delete]
```

Constructs a constant buffer from the given constant buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the constant buffer to copy. |
|----|---------------|---|

5.21.2.3 ConstantBuffer() [3/3]

```
template<typename DataT>
mage::ConstantBuffer< DataT >::ConstantBuffer (
    ConstantBuffer< DataT > && buffer ) [default]
```

Constructs a constant buffer by moving the given constant buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the constant buffer to move. |
|----|--------|---|

5.21.2.4 ~ConstantBuffer()

```
template<typename DataT>
mage::ConstantBuffer< DataT >::~ConstantBuffer ( ) [default]
```

Destructs this constant buffer.

5.21.3 Member Function Documentation**5.21.3.1 Get()**

```
template<typename DataT>
ID3D11Buffer* mage::ConstantBuffer< DataT >::Get ( ) const
```

Returns the buffer resource of this constant buffer.

Returns

A pointer to the buffer resource of this constant buffer.

5.21.3.2 GetAddressOf() [1/2]

```
template<typename DataT>
ID3D11Buffer* const* mage::ConstantBuffer< DataT >::GetAddressOf ( ) const
```

Returns the address of the buffer resource of this constant buffer.

Returns

A pointer to a pointer to the buffer resource of this constant buffer.

5.21.3.3 GetAddressOf() [2/2]

```
template<typename DataT>
ID3D11Buffer** mage::ConstantBuffer< DataT >::GetAddressOf ( )
```

Returns the address of the buffer resource of this constant buffer.

Returns

A pointer to a pointer to the buffer resource of this constant buffer.

5.21.3.4 operator=() [1/2]

```
template<typename DataT>
ConstantBuffer& mage::ConstantBuffer< DataT >::operator= (
    const ConstantBuffer< DataT > & buffer ) [delete]
```

Copies the given constant buffer to this constant buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the constant buffer to copy. |
|----|---------------|---|

Returns

A reference to the copy of the given constant buffer (i.e. this constant buffer).

5.21.3.5 operator=() [2/2]

```
template<typename DataT>
ConstantBuffer& mage::ConstantBuffer< DataT >::operator= (
    ConstantBuffer< DataT > && buffer ) [delete]
```

Moves the given constant buffer to this constant buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the constant buffer to move. |
|----|---------------|---|

Returns

A reference to the copy of the given constant buffer (i.e. this constant buffer).

5.21.3.6 SetupConstantBuffer()

```
template<typename DataT>
void mage::ConstantBuffer< DataT >::SetupConstantBuffer ( ) [private]
```

Sets up the resource buffer of this constant buffer.

Exceptions

| | |
|---------------------------|---------------------------------------|
| <i>FormattedException</i> | Failed to setup this constant buffer. |
|---------------------------|---------------------------------------|

5.21.3.7 UpdateData()

```
template<typename DataT>
void mage::ConstantBuffer< DataT >::UpdateData (
    const DataT & data ) const
```

Updates the data of constant buffer with the given data.

Parameters

| | | |
|----|-------------|--------------------------|
| in | <i>data</i> | A reference to the data. |
|----|-------------|--------------------------|

5.21.4 Member Data Documentation

5.21.4.1 m_buffer

```
template<typename DataT>
ComPtr< ID3D11Buffer > const mage::ConstantBuffer< DataT >::m_buffer [private]
```

A pointer to the buffer resource of this constant buffer.

5.21.4.2 m_device

```
template<typename DataT>
ID3D11Device2* const mage::ConstantBuffer< DataT >::m_device [private]
```

A pointer to the device of this constant buffer.

5.21.4.3 m_device_context

```
template<typename DataT>
ID3D11DeviceContext2* const mage::ConstantBuffer< DataT >::m_device_context [private]
```

A pointer to the device context of this constant buffer.

5.22 mage::CPUMonitor Class Reference

```
#include <cpu_monitor.hpp>
```

Public Member Functions

- [CPUMonitor \(\)](#)
- [CPUMonitor \(const CPUMonitor &cpu_monitor\)](#)
- [CPUMonitor \(CPUMonitor &&cpu_monitor\)=default](#)
- [~CPUMonitor \(\)=default](#)
- [CPUMonitor & operator= \(const CPUMonitor &cpu_monitor\)](#)
- [CPUMonitor & operator= \(CPUMonitor &&cpu_monitor\)=default](#)
- [void Start \(\)](#)
- [void Stop \(\)](#)
- [void Restart \(\)](#)
- [void Resume \(\)](#)
- [double GetCPUDeltaPercentage \(\) const](#)
- [double GetTotalCPUDeltaPercentage \(\) const](#)

Private Attributes

- [UniquePtr< Timer > m_timer](#)
- [UniquePtr< CPUTimer > m_cpu_timer](#)

5.22.1 Detailed Description

A class of CPU monitors for monitoring CPU usage.

5.22.2 Constructor & Destructor Documentation

5.22.2.1 CPUMonitor() [1/3]

```
mage::CPUMonitor::CPUMonitor ( )
```

Constructs a CPU monitor.

5.22.2.2 CPUMonitor() [2/3]

```
mage::CPUMonitor::CPUMonitor (
    const CPUMonitor & cpu_monitor )
```

Constructs a CPU monitor from the given CPU monitor.

Parameters

| | | |
|----|--------------------|---|
| in | <i>cpu_monitor</i> | A reference to the CPU monitor to copy. |
|----|--------------------|---|

5.22.2.3 CPUMonitor() [3/3]

```
mage::CPUMonitor::CPUMonitor (
    CPUMonitor && cpu_monitor ) [default]
```

Constructs a CPU monitor by moving the given CPU monitor.

Parameters

| | | |
|----|--------------------|---|
| in | <i>cpu_monitor</i> | A reference to the CPU monitor to move. |
|----|--------------------|---|

5.22.2.4 ~CPUMonitor()

```
mage::CPUMonitor::~CPUMonitor ( ) [default]
```

Destructs this CPU monitor.

5.22.3 Member Function Documentation

5.22.3.1 GetCPUDeltaPercentage()

```
double mage::CPUMonitor::GetCPUDeltaPercentage ( ) const
```

Returns the CPU delta percentage of this CPU monitor's process.

Returns

The CPU delta percentage of this CPU monitor's process.

5.22.3.2 GetTotalCPUDeltaPercentage()

```
double mage::CPUMonitor::GetTotalCPUDeltaPercentage ( ) const
```

Returns the total CPU delta percentage of this CPU monitor's process.

Returns

The total CPU delta percentage of this CPU monitor's process.

5.22.3.3 operator=() [1/2]

```
CPUMonitor& mage::CPUMonitor::operator= (
    const CPUMonitor & cpu_monitor )
```

Copies the given CPU monitor to this CPU monitor.

Parameters

| | | |
|----|--------------------|---|
| in | <i>cpu_monitor</i> | A reference to the CPU monitor to copy. |
|----|--------------------|---|

Returns

A reference to the copy of the given CPU monitor (i.e. this CPU monitor).

5.22.3.4 operator=() [2/2]

```
CPUMonitor& mage::CPUMonitor::operator= (
    CPUMonitor && cpu_monitor ) [default]
```

Moves the given CPU monitor to this CPU monitor.

Parameters

| | | |
|----|--------------------|---|
| in | <i>cpu_monitor</i> | A reference to the CPU monitor to move. |
|----|--------------------|---|

Returns

A reference to the moved CPU monitor (i.e. this CPU monitor).

5.22.3.5 Restart()

```
void mage::CPUMonitor::Restart ( )
```

Restarts this CPU monitor.

5.22.3.6 Resume()

```
void mage::CPUMonitor::Resume ( )
```

Resumes this CPU monitor.

5.22.3.7 Start()

```
void mage::CPUMonitor::Start ( )
```

Starts this CPU monitor.

5.22.3.8 Stop()

```
void mage::CPUMonitor::Stop ( )
```

Stops this CPU monitor.

5.22.4 Member Data Documentation

5.22.4.1 m_cpu_timer

```
UniquePtr< CPUTimer > mage::CPUMonitor::m_cpu_timer [private]
```

A pointer to the CPU core timer of this CPU monitor.

5.22.4.2 m_timer

```
UniquePtr< Timer > mage::CPUMonitor::m_timer [private]
```

A pointer to the wallclock timer of this CPU monitor.

5.23 mage::CPUTimer Class Reference

```
#include <cpu_timer.hpp>
```

Public Member Functions

- `CPUTimer ()`
- `CPUTimer (const CPUTimer &timer)=default`
- `CPUTimer (CPUTimer &&timer)=default`
- `~CPUTimer ()=default`
- `CPUTimer & operator= (const CPUTimer &timer)=default`
- `CPUTimer & operator= (CPUTimer &&timer)=default`
- `void Start ()`
- `void Stop ()`
- `void Restart ()`
- `void Resume ()`
- `double GetCoreDeltaTimePerCore () const`
- `double GetCoreDeltaTime () const`
- `double GetKernelModeDeltaTimePerCore () const`
- `double GetKernelModeDeltaTime () const`
- `double GetUserModeDeltaTimePerCore () const`
- `double GetUserModeDeltaTime () const`
- `double GetTotalCoreDeltaTimePerCore () const`
- `double GetTotalCoreDeltaTime () const`
- `double GetTotalKernelModeDeltaTimePerCore () const`
- `double GetTotalKernelModeDeltaTime () const`
- `double GetTotalUserModeDeltaTimePerCore () const`
- `double GetTotalUserModeDeltaTime () const`

Private Types

- `enum { KERNEL_MODE = 0, USER_MODE = 1, NB_MODES = 2 }`

Private Member Functions

- `void UpdateLastTimestamp () const`
- `void ResetDeltaTime () const`
- `void UpdateDeltaTime () const`

Private Attributes

- `HANDLE m_handle`
- `size_t m_nb_processor_cores`
- `uint64_t m_last_timestamp [NB_MODES]`
- `uint64_t m_delta_time [NB_MODES]`
- `uint64_t m_total_delta_time [NB_MODES]`
- `bool m_running`

Static Private Attributes

- `static const double time_period = 0.0000001`

5.23.1 Detailed Description

A class of CPU timers.

5.23.2 Member Enumeration Documentation

5.23.2.1 anonymous enum

```
anonymous enum [private]
```

An enumeration of the different modes of this CPU timer..

Enumerator

| | |
|-------------|--|
| KERNEL_MODE | |
| USER_MODE | |
| NB_MODES | |

5.23.3 Constructor & Destructor Documentation

5.23.3.1 CPUTimer() [1/3]

```
mage::CPUTimer::CPUTimer ( )
```

Constructs a CPU timer.

5.23.3.2 CPUTimer() [2/3]

```
mage::CPUTimer::CPUTimer (
    const CPUTimer & timer ) [default]
```

Constructs a CPU timer from the given CPU timer.

Parameters

| | | |
|----|-------|---------------------------------------|
| in | timer | A reference to the CPU timer to copy. |
|----|-------|---------------------------------------|

5.23.3.3 CPUTimer() [3/3]

```
mage::CPUTimer::CPUTimer (
    CPUTimer && timer ) [default]
```

Constructs a CPU timer by moving the given CPU timer.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>timer</i> | A reference to the CPU timer to move. |
|----|--------------|---------------------------------------|

5.23.3.4 ~CPUTimer()

```
mage::CPUTimer::~CPUTimer() [default]
```

Destructs this CPU timer.

5.23.4 Member Function Documentation**5.23.4.1 GetCoreDeltaTime()**

```
double mage::CPUTimer::GetCoreDeltaTime() const
```

Returns the core delta time (in seconds) of this CPU timer's process.

Returns

The core delta time (in seconds) of this CPU timer's process.

5.23.4.2 GetCoreDeltaTimePerCore()

```
double mage::CPUTimer::GetCoreDeltaTimePerCore() const
```

Returns the core delta time (in seconds) per processing core of this CPU timer's process.

Returns

The core delta time (in seconds) per processing core of this CPU timer's process.

5.23.4.3 GetKernelModeDeltaTime()

```
double mage::CPUTimer::GetKernelModeDeltaTime() const
```

Returns the kernel mode delta time (in seconds) of this CPU timer's process.

Returns

The kernel mode delta time (in seconds) of this CPU timer's process.

5.23.4.4 GetKernelModeDeltaTimePerCore()

```
double mage::CPUTimer::GetKernelModeDeltaTimePerCore ( ) const
```

Returns the kernel mode delta time (in seconds) per processing core of this CPU timer's process.

Returns

The kernel mode delta time (in seconds) per processing core of this CPU timer's process.

5.23.4.5 GetTotalCoreDeltaTime()

```
double mage::CPUTimer::GetTotalCoreDeltaTime ( ) const
```

Returns the total core delta time (in seconds) of this CPU timer's process.

Returns

The total core delta time (in seconds) of this CPU timer's process.

5.23.4.6 GetTotalCoreDeltaTimePerCore()

```
double mage::CPUTimer::GetTotalCoreDeltaTimePerCore ( ) const
```

Returns the total core delta time (in seconds) per processing core of this CPU timer's process.

Returns

The total core delta time (in seconds) per processing core of this CPU timer's process.

5.23.4.7 GetTotalKernelModeDeltaTime()

```
double mage::CPUTimer::GetTotalKernelModeDeltaTime ( ) const
```

Returns the total kernel mode delta time (in seconds) of this CPU timer's process.

Returns

The total kernel mode delta time (in seconds) of this CPU timer's process.

5.23.4.8 GetTotalKernelModeDeltaTimePerCore()

```
double mage::CPUTimer::GetTotalKernelModeDeltaTimePerCore ( ) const
```

Returns the total kernel mode delta time (in seconds) per processing core of this CPU timer's process.

Returns

The total kernel mode delta time (in seconds) per processing core of this CPU timer's process.

5.23.4.9 GetTotalUserModeDeltaTime()

```
double mage::CPUTimer::GetTotalUserModeDeltaTime ( ) const
```

Returns the total user mode delta time (in seconds) of this CPU timer's process.

Returns

The total user mode delta time (in seconds) of this CPU timer's process.

5.23.4.10 GetTotalUserModeDeltaTimePerCore()

```
double mage::CPUTimer::GetTotalUserModeDeltaTimePerCore ( ) const
```

Returns the total user mode delta time (in seconds) per processing core of this CPU timer's process.

Returns

The total user mode delta time (in seconds) per processing core of this CPU timer's process.

5.23.4.11 GetUserModeDeltaTime()

```
double mage::CPUTimer::GetUserModeDeltaTime ( ) const
```

Returns the user mode delta time (in seconds) of this CPU timer's process.

Returns

The user mode delta time (in seconds) of this CPU timer's process.

5.23.4.12 GetUserModeDeltaTimePerCore()

```
double mage::CPUTimer:: GetUserModeDeltaTimePerCore ( ) const
```

Returns the user mode delta time (in seconds) per processing core of this CPU timer's process.

Returns

The user mode delta time (in seconds) per processing core of this CPU timer's process.

5.23.4.13 operator=() [1/2]

```
CPUTimer& mage::CPUTimer::operator= (
    const CPUTimer & timer ) [default]
```

Copies the given CPU timer to this CPU timer.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>timer</i> | A reference to the CPU timer to copy. |
|----|--------------|---------------------------------------|

Returns

A reference to the copy of the given CPU timer (i.e. this CPU timer).

5.23.4.14 operator=() [2/2]

```
CPUTimer& mage::CPUTimer::operator= (
    CPUTimer && timer ) [default]
```

Moves the given CPU timer to this CPU timer.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>timer</i> | A reference to the CPU timer to move. |
|----|--------------|---------------------------------------|

Returns

A reference to the moved CPU timer (i.e. this CPU timer).

5.23.4.15 ResetDeltaTime()

```
void mage::CPUTimer::ResetDeltaTime ( ) const [private]
```

Resets the modes' delta times, total delta times and last timestamps of this CPU timer's process.

5.23.4.16 Restart()

```
void mage::CPUTimer::Restart ( )
```

Restarts this CPU timer.

5.23.4.17 Resume()

```
void mage::CPUTimer::Resume ( )
```

Resumes this CPU timer.

5.23.4.18 Start()

```
void mage::CPUTimer::Start ( )
```

Starts this CPU timer.

5.23.4.19 Stop()

```
void mage::CPUTimer::Stop ( )
```

Stops this CPU timer.

5.23.4.20 UpdateDeltaTime()

```
void mage::CPUTimer::UpdateDeltaTime ( ) const [private]
```

Updates the modes' delta times, total delta times and last timestamps of this CPU timer's process.

5.23.4.21 UpdateLastTimestamp()

```
void mage::CPUTimer::UpdateLastTimestamp ( ) const [private]
```

Updates the modes' last timestamps of this CPU timer's process.

5.23.5 Member Data Documentation

5.23.5.1 m_delta_time

```
uint64_t mage::CPUTimer::m_delta_time[NB_MODES] [mutable], [private]
```

The modes' delta times (in seconds) of this CPU timer's process.

5.23.5.2 m_handle

```
HANDLE mage::CPUTimer::m_handle [private]
```

The process handle.

5.23.5.3 m_last_timestamp

```
uint64_t mage::CPUTimer::m_last_timestamp[NB_MODES] [mutable], [private]
```

The modes' last timestamps of this CPU timer's process.

5.23.5.4 m_nb_processor_cores

```
size_t mage::CPUTimer::m_nb_processor_cores [private]
```

The number of processor cores.

5.23.5.5 m_running

```
bool mage::CPUTimer::m_running [private]
```

Flag indicating whether this CPU timer is running.

5.23.5.6 m_total_delta_time

```
uint64_t mage::CPUTimer::m_total_delta_time[NB_MODES] [mutable], [private]
```

The modes' total delta times (in seconds) of this CPU timer's process.

5.23.5.7 time_period

```
const double mage::CPUTimer::time_period = 0.0000001 [static], [private]
```

The time period of CPU timers.

5.24 mage::DDS_HEADER Struct Reference

Public Attributes

- `uint32_t size`
- `uint32_t flags`
- `uint32_t height`
- `uint32_t width`
- `uint32_t pitch_or_linear_size`
- `uint32_t depth`
- `uint32_t mip_map_count`
- `uint32_t reserved1 [11]`
- `DDS_PIXELFORMAT ddspf`
- `uint32_t caps`
- `uint32_t caps2`
- `uint32_t caps3`
- `uint32_t caps4`
- `uint32_t reserved2`

5.24.1 Member Data Documentation

5.24.1.1 caps

```
uint32_t mage::DDS_HEADER::caps
```

5.24.1.2 caps2

```
uint32_t mage::DDS_HEADER::caps2
```

5.24.1.3 caps3

```
uint32_t mage::DDS_HEADER::caps3
```

5.24.1.4 caps4

```
uint32_t mage::DDS_HEADER::caps4
```

5.24.1.5 ddspf

```
DDS_PIXELFORMAT mage::DDS_HEADER::ddspf
```

5.24.1.6 depth

```
uint32_t mage::DDS_HEADER::depth
```

5.24.1.7 flags

```
uint32_t mage::DDS_HEADER::flags
```

5.24.1.8 height

```
uint32_t mage::DDS_HEADER::height
```

5.24.1.9 mip_map_count

```
uint32_t mage::DDS_HEADER::mip_map_count
```

5.24.1.10 pitch_or_linear_size

```
uint32_t mage::DDS_HEADER::pitch_or_linear_size
```

5.24.1.11 reserved1

```
uint32_t mage::DDS_HEADER::reserved1[11]
```

5.24.1.12 reserved2

```
uint32_t mage::DDS_HEADER::reserved2
```

5.24.1.13 size

```
uint32_t mage::DDS_HEADER::size
```

5.24.1.14 width

```
uint32_t mage::DDS_HEADER::width
```

5.25 mage::DDS_HEADER_DXT10 Struct Reference

Public Attributes

- DXGI_FORMAT [dxgi_format](#)
- uint32_t [resource_dimension](#)
- uint32_t [misc_flag](#)
- uint32_t [array_size](#)
- uint32_t [misc_flags2](#)

5.25.1 Member Data Documentation

5.25.1.1 array_size

```
uint32_t mage::DDS_HEADER_DXT10::array_size
```

5.25.1.2 dxgi_format

```
DXGI_FORMAT mage::DDS_HEADER_DXT10::dxgi_format
```

5.25.1.3 misc_flag

```
uint32_t mage::DDS_HEADER_DXT10::misc_flag
```

5.25.1.4 misc_flags2

```
uint32_t mage::DDS_HEADER_DXT10::misc_flags2
```

5.25.1.5 resource_dimension

```
uint32_t mage::DDS_HEADER_DXT10::resource_dimension
```

5.26 mage::DDS_PIXELFORMAT Struct Reference

Public Attributes

- `uint32_t size`
- `uint32_t flags`
- `uint32_t fourCC`
- `uint32_t RGBBitCount`
- `uint32_t RBitMask`
- `uint32_t GBitMask`
- `uint32_t BBitMask`
- `uint32_t ABitMask`

5.26.1 Member Data Documentation

5.26.1.1 ABitMask

```
uint32_t mage::DDS_PIXELFORMAT::ABitMask
```

5.26.1.2 BBitMask

```
uint32_t mage::DDS_PIXELFORMAT::BBitMask
```

5.26.1.3 flags

```
uint32_t mage::DDS_PIXELFORMAT::flags
```

5.26.1.4 fourCC

```
uint32_t mage::DDS_PIXELFORMAT::fourCC
```

5.26.1.5 GBitMask

```
uint32_t mage::DDS_PIXELFORMAT::GBitMask
```

5.26.1.6 RBitMask

```
uint32_t mage::DDS_PIXELFORMAT::RBitMask
```

5.26.1.7 RGBBitCount

```
uint32_t mage::DDS_PIXELFORMAT::RGBBitCount
```

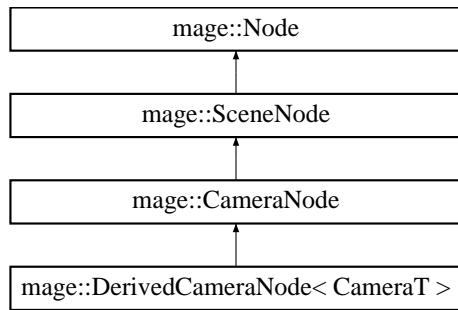
5.26.1.8 size

```
uint32_t mage::DDS_PIXELFORMAT::size
```

5.27 mage::DerivedCameraNode< CameraT > Class Template Reference

```
#include <camera_node.hpp>
```

Inheritance diagram for mage::DerivedCameraNode< CameraT >:



Public Member Functions

- [DerivedCameraNode \(const string &name\)](#)
- [DerivedCameraNode \(const string &name, UniquePtr< CameraT > &&camera\)](#)
- [DerivedCameraNode \(const DerivedCameraNode &camera_node\)](#)
- [DerivedCameraNode \(DerivedCameraNode &&camera_node\)](#)
- [virtual ~DerivedCameraNode \(\)](#)
- [DerivedCameraNode & operator= \(const DerivedCameraNode &camera_node\)=delete](#)
- [DerivedCameraNode & operator= \(DerivedCameraNode &&camera_node\)=delete](#)
- [UniquePtr< DerivedCameraNode > Clone \(\) const](#)
- [CameraT * GetCamera \(\)](#)
- [const CameraT * GetCamera \(\) const](#)

Private Member Functions

- [virtual UniquePtr< Node > CloneImplementation \(\) const override](#)

Additional Inherited Members

5.27.1 Constructor & Destructor Documentation

5.27.1.1 DerivedCameraNode() [1/4]

```
template<typename CameraT >
mage::DerivedCameraNode< CameraT >::DerivedCameraNode (
    const string & name ) [explicit]
```

5.27.1.2 DerivedCameraNode() [2/4]

```
template<typename CameraT >
mage::DerivedCameraNode< CameraT >::DerivedCameraNode (
    const string & name,
    UniquePtr< CameraT > && camera ) [explicit]
```

5.27.1.3 DerivedCameraNode() [3/4]

```
template<typename CameraT >
mage::DerivedCameraNode< CameraT >::DerivedCameraNode (
    const DerivedCameraNode< CameraT > & camera_node )
```

5.27.1.4 DerivedCameraNode() [4/4]

```
template<typename CameraT >
mage::DerivedCameraNode< CameraT >::DerivedCameraNode (
    DerivedCameraNode< CameraT > && camera_node )
```

5.27.1.5 ~DerivedCameraNode()

```
template<typename CameraT >
virtual mage::DerivedCameraNode< CameraT >::~DerivedCameraNode ( ) [virtual]
```

5.27.2 Member Function Documentation

5.27.2.1 Clone()

```
template<typename CameraT >
UniquePtr< DerivedCameraNode > mage::DerivedCameraNode< CameraT >::Clone ( ) const
```

5.27.2.2 ClonImplementation()

```
template<typename CameraT >
virtual UniquePtr< Node > mage::DerivedCameraNode< CameraT >::ClonImplementation ( ) const
[override], [private], [virtual]
```

Clones this node.

Returns

A pointer to the clone of this node.

Implements [mage::CameraNode](#).

5.27.2.3 GetCamera() [1/2]

```
template<typename CameraT >
CameraT* mage::DerivedCameraNode< CameraT >::GetCamera ( )
```

5.27.2.4 GetCamera() [2/2]

```
template<typename CameraT >
const CameraT* mage::DerivedCameraNode< CameraT >::GetCamera ( ) const
```

5.27.2.5 operator=() [1/2]

```
template<typename CameraT >
DerivedCameraNode& mage::DerivedCameraNode< CameraT >::operator= (
    const DerivedCameraNode< CameraT > & camera_node ) [delete]
```

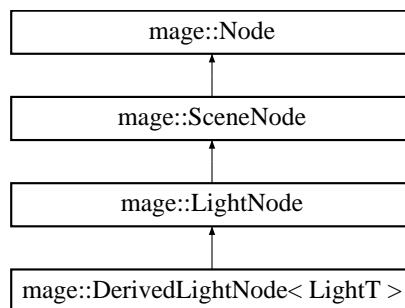
5.27.2.6 operator=() [2/2]

```
template<typename CameraT >
DerivedCameraNode& mage::DerivedCameraNode< CameraT >::operator= (
    DerivedCameraNode< CameraT > && camera_node ) [delete]
```

5.28 mage::DerivedLightNode< LightT > Class Template Reference

```
#include <light_node.hpp>
```

Inheritance diagram for mage::DerivedLightNode< LightT >:



Public Member Functions

- [DerivedLightNode \(const string &name\)](#)
- [DerivedLightNode \(const string &name, UniquePtr< LightT > &&light\)](#)
- [DerivedLightNode \(const DerivedLightNode &light_node\)](#)
- [DerivedLightNode \(DerivedLightNode &&light_node\)](#)
- [virtual ~DerivedLightNode \(\)](#)
- [DerivedLightNode & operator= \(const DerivedLightNode &light_node\)=delete](#)
- [DerivedLightNode & operator= \(DerivedLightNode &&light_node\)=delete](#)
- [UniquePtr< DerivedLightNode > Clone \(\) const](#)
- [LightT * GetLight \(\)](#)
- [const LightT * GetLight \(\) const](#)

Private Member Functions

- virtual UniquePtr< Node > CloneImplementation () const override

Additional Inherited Members

5.28.1 Constructor & Destructor Documentation

5.28.1.1 DerivedLightNode() [1/4]

```
template<typename LightT >
mage::DerivedLightNode< LightT >::DerivedLightNode (
    const string & name )  [explicit]
```

5.28.1.2 DerivedLightNode() [2/4]

```
template<typename LightT >
mage::DerivedLightNode< LightT >::DerivedLightNode (
    const string & name,
    UniquePtr< LightT > && light )  [explicit]
```

5.28.1.3 DerivedLightNode() [3/4]

```
template<typename LightT >
mage::DerivedLightNode< LightT >::DerivedLightNode (
    const DerivedLightNode< LightT > & light_node )
```

5.28.1.4 DerivedLightNode() [4/4]

```
template<typename LightT >
mage::DerivedLightNode< LightT >::DerivedLightNode (
    DerivedLightNode< LightT > && light_node )
```

5.28.1.5 ~DerivedLightNode()

```
template<typename LightT >
virtual mage::DerivedLightNode< LightT >::~DerivedLightNode ( )  [virtual]
```

5.28.2 Member Function Documentation

5.28.2.1 Clone()

```
template<typename LightT >
UniquePtr< DerivedLightNode > mage::DerivedLightNode< LightT >::Clone ( ) const
```

5.28.2.2 `CloneImplementation()`

```
template<typename LightT >
virtual UniquePtr< Node > mage::DerivedLightNode< LightT >::CloneImplementation ( ) const
[override], [private], [virtual]
```

Clones this node.

Returns

A pointer to the clone of this node.

Implements `mage::LightNode`.

5.28.2.3 `GetLight()` [1/2]

```
template<typename LightT >
LightT* mage::DerivedLightNode< LightT >::GetLight ( )
```

5.28.2.4 `GetLight()` [2/2]

```
template<typename LightT >
const LightT* mage::DerivedLightNode< LightT >::GetLight ( ) const
```

5.28.2.5 `operator=()` [1/2]

```
template<typename LightT >
DerivedLightNode& mage::DerivedLightNode< LightT >::operator= (
    const DerivedLightNode< LightT > & light_node ) [delete]
```

5.28.2.6 `operator=()` [2/2]

```
template<typename LightT >
DerivedLightNode& mage::DerivedLightNode< LightT >::operator= (
    DerivedLightNode< LightT > && light_node ) [delete]
```

5.29 `mage::DeviceEnumeration` Class Reference

```
#include <device_enumeration.hpp>
```

Public Member Functions

- `DeviceEnumeration & operator= (const DeviceEnumeration &device_enumeration)=delete`
- `DeviceEnumeration & operator= (DeviceEnumeration &&device_enumeration)=delete`
- `ComPtr< IDXGIAdapter2 > GetAdapter () const`
- `ComPtr< IDXGIOutput2 > GetOutput () const`
- `const DXGI_MODE_DESC1 * GetDisplayMode () const`
- `bool IsWindowed () const`
- `bool IsFullScreen () const`
- `bool IsVSynced () const`

Private Member Functions

- `DeviceEnumeration ()`
- `DeviceEnumeration (const DeviceEnumeration &device_enumeration)=delete`
- `DeviceEnumeration (DeviceEnumeration &&device_enumeration)`
- `~DeviceEnumeration ()`
- `void InitializeAdapterAndOutput ()`
- `void InitializeDisplayModes ()`
- `HRESULT Enumerate ()`
- `INT_PTR SettingsDialogProc (HWND hwndDlg, UINT uMsg, WPARAM wParam, LPARAM lParam)`

Private Attributes

- `ComPtr< IDXGIAdapter2 > m_adapter`
- `ComPtr< IDXGIOoutput2 > m_output`
- `UniquePtr< VariableScript > m_settings_script`
- `list< DXGI_MODE_DESC1 > m_display_modes`
- `const DXGI_MODE_DESC1 * m_selected_diply_mode`
- `bool m_windowed`
- `bool m_vsync`

Friends

- class `Engine`
- `INT_PTR CALLBACK SettingsDialogProcDelegate (HWND hwndDlg, UINT uMsg, WPARAM wParam, LPARAM lParam)`

5.29.1 Detailed Description

A class of device enumerations.

5.29.2 Constructor & Destructor Documentation

5.29.2.1 DeviceEnumeration() [1/3]

```
mage::DeviceEnumeration::DeviceEnumeration ( ) [private]
```

Constructs a device enumeration.

5.29.2.2 DeviceEnumeration() [2/3]

```
mage::DeviceEnumeration::DeviceEnumeration (
    const DeviceEnumeration & device_enumeration ) [private], [delete]
```

Constructs a device enumeration from the given device enumeration.

Parameters

| | | |
|----|---------------------------|--|
| in | <i>device_enumeration</i> | A reference to a device enumeration to copy. |
|----|---------------------------|--|

5.29.2.3 DeviceEnumeration() [3/3]

```
mage::DeviceEnumeration::DeviceEnumeration (
    DeviceEnumeration && device_enumeration) [private], [default]
```

Constructs a device enumeration by moving the given device enumeration.

Parameters

| | | |
|----|---------------------------|--|
| in | <i>device_enumeration</i> | A reference to a device enumeration to move. |
|----|---------------------------|--|

5.29.2.4 ~DeviceEnumeration()

```
mage::DeviceEnumeration::~DeviceEnumeration () [private], [default]
```

Destructs this device enumeration.

5.29.3 Member Function Documentation**5.29.3.1 Enumerate()**

```
HRESULT mage::DeviceEnumeration::Enumerate () [private]
```

Enumerates the available display modes on the adapter output of the physical adapter with the most dedicated video memory.

Returns

A success/error value.

5.29.3.2 GetAdapter()

```
ComPtr< IDXGIAdapter2> mage::DeviceEnumeration::GetAdapter () const
```

Returns the adapter of this device enumeration.

Returns

A pointer to the adapter of this device enumeration.

5.29.3.3 GetDisplayMode()

```
const DXGI_MODE_DESC1* mage::DeviceEnumeration::GetDisplayMode( ) const
```

Returns the selected display mode by the user of this device enumeration.

Returns

A pointer to the selected display mode of this device enumeration.

5.29.3.4 GetOutput()

```
ComPtr< IDXGIOutput2> mage::DeviceEnumeration::GetOutput( ) const
```

Returns the output of this device enumeration.

Returns

A pointer to the output of this device enumeration.

5.29.3.5 InitializeAdapterAndOutput()

```
void mage::DeviceEnumeration::InitializeAdapterAndOutput( ) [private]
```

Initializes the adapter and the output of this device enumeration.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to initialize the adapter and the output of this device enumeration. |
|---------------------------|---|

5.29.3.6 InitializeDisplayModes()

```
void mage::DeviceEnumeration::InitializeDisplayModes( ) [private]
```

Initializes the display modes of this device enumeration.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to initialize the display modes of this device enumeration. |
|---------------------------|--|

5.29.3.7 IsFullScreen()

```
bool mage::DeviceEnumeration::IsFullScreen( ) const
```

Checks whether the application should run in full screen mode.

Returns

`true` if the application should run in full screen mode. `false` otherwise.

5.29.3.8 IsVSynced()

```
bool mage::DeviceEnumeration::IsVSynced ( ) const
```

Checks whether V-sync should be enabled.

Returns

`true` if v-sync should be enabled. `false` otherwise.

5.29.3.9 IsWindowed()

```
bool mage::DeviceEnumeration::IsWindowed ( ) const
```

Checks whether the application should run in windowed mode.

Returns

`true` if the application should run in windowed mode. `false` otherwise.

5.29.3.10 operator=() [1/2]

```
DeviceEnumeration& mage::DeviceEnumeration::operator= (
    const DeviceEnumeration & device_enumeration ) [delete]
```

Copies the given device enumeration to this device enumeration.

Parameters

| | | |
|----|---------------------------------|--|
| in | <code>device_enumeration</code> | A reference to a device enumeration to copy. |
|----|---------------------------------|--|

Returns

A reference to the copy of the given device enumeration (i.e. this device enumeration).

5.29.3.11 operator=() [2/2]

```
DeviceEnumeration& mage::DeviceEnumeration::operator= (
    DeviceEnumeration && device_enumeration ) [delete]
```

Moves the given device enumeration to this device enumeration.

Parameters

| | | |
|-----------------|---------------------------------|--|
| <code>in</code> | <code>device_enumeration</code> | A reference to a device enumeration to move. |
|-----------------|---------------------------------|--|

Returns

A reference to the moved device enumeration (i.e. this device enumeration).

5.29.3.12 SettingsDialogProc()

```
INT_PTR mage::DeviceEnumeration::SettingsDialogProc (
    HWND hwndDlg,
    UINT uMsg,
    WPARAM wParam,
    LPARAM lParam ) [private]
```

Engine-defined callback function used with the CreateDialog for device enumeration.

Parameters

| | | |
|-----------------|----------------------|--|
| <code>in</code> | <code>hwndDlg</code> | A handle to the dialog box. |
| <code>in</code> | <code>uMsg</code> | The message. |
| <code>in</code> | <code>wParam</code> | Additional message-specific information. |
| <code>in</code> | <code>lParam</code> | Additional message-specific information. |

Returns

`true` if `uMsg` is processed. `false` otherwise.

5.29.4 Friends And Related Function Documentation**5.29.4.1 Engine**

```
friend class Engine [friend]
```

5.29.4.2 SettingsDialogProcDelegate

```
INT_PTR CALLBACK SettingsDialogProcDelegate (
    HWND hwndDlg,
    UINT uMsg,
    WPARAM wParam,
    LPARAM lParam ) [friend]
```

Engine-defined callback function used with the CreateDialog for device enumeration.

Parameters

| | | |
|-----------------|----------------------|--|
| <code>in</code> | <code>hwndDlg</code> | A handle to the dialog box. |
| <code>in</code> | <code>uMsg</code> | The message. |
| <code>in</code> | <code>wParam</code> | Additional message-specific information. |
| <code>in</code> | <code>lParam</code> | Additional message-specific information. |

Returns

true if *uMsg* is processed. false otherwise.

5.29.5 Member Data Documentation

5.29.5.1 m_adapter

```
ComPtr< IDXGIAdapter2 > mage::DeviceEnumeration::m_adapter [private]
```

A pointer to the adapter (or video card).

5.29.5.2 m_display_modes

```
list< DXGI_MODE_DESC1 > mage::DeviceEnumeration::m_display_modes [private]
```

The linked list of enumerated display modes.

5.29.5.3 m_output

```
ComPtr< IDXGIOoutput2 > mage::DeviceEnumeration::m_output [private]
```

A pointer to the output.

5.29.5.4 m_selected_diplay_mode

```
const DXGI_MODE_DESC1* mage::DeviceEnumeration::m_selected_diplay_mode [private]
```

A pointer to the selected display mode by the user.

5.29.5.5 m_settings_script

```
UniquePtr< VariableScript > mage::DeviceEnumeration::m_settings_script [private]
```

A pointer to the script which stores the device configuration.

5.29.5.6 m_vsync

```
bool mage::DeviceEnumeration::m_vsync [private]
```

Flag indicating whether V-sync should be enabled.

5.29.5.7 m_windowed

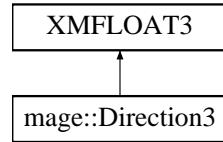
```
bool mage::DeviceEnumeration::m_windowed [private]
```

Flag indicating whether the application should run in windowed mode.

5.30 mage::Direction3 Struct Reference

```
#include <math.hpp>
```

Inheritance diagram for mage::Direction3:



Public Member Functions

- [Direction3 \(\)](#)
- [Direction3 \(float x, float y, float z\)](#)
- [Direction3 \(const Direction3 &direction\)](#)
- [Direction3 \(Direction3 &&direction\)](#)
- [Direction3 \(const Normal3 &normal\)](#)
- [Direction3 \(Normal3 &&normal\)](#)
- [Direction3 \(const XMFLOAT3 &v\)](#)
- [Direction3 \(XMFLOAT3 &&v\)](#)
- [~Direction3 \(\)=default](#)
- [Direction3 & operator= \(const Direction3 &direction\)](#)
- [Direction3 & operator= \(Direction3 &&direction\)](#)

5.30.1 Detailed Description

A struct of directions in 3D space.

5.30.2 Constructor & Destructor Documentation

5.30.2.1 [Direction3\(\)](#) [1/8]

```
mage::Direction3::Direction3 ( )
```

Constructs a direction.

5.30.2.2 [Direction3\(\)](#) [2/8]

```
mage::Direction3::Direction3 ( float x, float y, float z )
```

Constructs a direction from the given coordinates.

Parameters

| | | |
|----|---|-------------------|
| in | x | The x-coordinate. |
| in | y | The y-coordinate. |
| in | z | The z-coordinate. |

5.30.2.3 Direction3() [3/8]

```
mage::Direction3::Direction3 (
    const Direction3 & direction )
```

Constructs a direction from the given direction.

Parameters

| | | |
|----|-----------|---------------------------------------|
| in | direction | A reference to the direction to copy. |
|----|-----------|---------------------------------------|

5.30.2.4 Direction3() [4/8]

```
mage::Direction3::Direction3 (
    Direction3 && direction )
```

Constructs a direction by moving the given direction.

Parameters

| | | |
|----|-----------|---------------------------------------|
| in | direction | A reference to the direction to move. |
|----|-----------|---------------------------------------|

5.30.2.5 Direction3() [5/8]

```
mage::Direction3::Direction3 (
    const Normal3 & normal )
```

Constructs a direction from the given normal.

Parameters

| | | |
|----|--------|------------------------------------|
| in | normal | A reference to the normal to copy. |
|----|--------|------------------------------------|

5.30.2.6 Direction3() [6/8]

```
mage::Direction3::Direction3 (
    Normal3 && normal )
```

Constructs a direction by moving the given normal.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>normal</i> | A reference to the normal to move. |
|----|---------------|------------------------------------|

5.30.2.7 Direction3() [7/8]

```
mage::Direction3::Direction3 (
    const XMFLOAT3 & v ) [explicit]
```

Constructs a direction from the given vector.

Parameters

| | | |
|----|----------|------------------------------------|
| in | <i>v</i> | A reference to the vector to copy. |
|----|----------|------------------------------------|

5.30.2.8 Direction3() [8/8]

```
mage::Direction3::Direction3 (
    XMFLOAT3 && v ) [explicit]
```

Constructs a direction by moving the given vector.

Parameters

| | | |
|----|----------|------------------------------------|
| in | <i>v</i> | A reference to the vector to move. |
|----|----------|------------------------------------|

5.30.2.9 ~Direction3()

```
mage::Direction3::~Direction3 ( ) [default]
```

Constructs a direction.

5.30.3 Member Function Documentation

5.30.3.1 operator=() [1/2]

```
Direction3& mage::Direction3::operator=
    const Direction3 & direction )
```

Copies the given direction to this direction.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>direction</i> | A reference to the direction to copy. |
|----|------------------|---------------------------------------|

Returns

A reference to the copy of the given direction (i.e. this direction).

5.30.3.2 operator=() [2/2]

```
Direction3& mage::Direction3::operator= (
    Direction3 && direction )
```

Moves the given direction to this direction.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>direction</i> | A reference to the direction to move. |
|----|------------------|---------------------------------------|

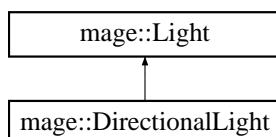
Returns

A reference to the moved direction (i.e. this direction).

5.31 mage::DirectionalLight Class Reference

```
#include <directional_light.hpp>
```

Inheritance diagram for mage::DirectionalLight:

**Public Member Functions**

- [DirectionalLight \(const RGBSpectrum &intensity=RGBSpectrum\(1.0f, 1.0f, 1.0f\)\)](#)
- [DirectionalLight \(const DirectionalLight &light\)](#)
- [DirectionalLight \(DirectionalLight &&light\)](#)
- [virtual ~DirectionalLight \(\)](#)
- [DirectionalLight & operator= \(const DirectionalLight &light\)](#)
- [DirectionalLight & operator= \(DirectionalLight &&light\)](#)
- [UniquePtr< DirectionalLight > Clone \(\) const](#)

Private Member Functions

- [virtual UniquePtr< Light > CloneImplementation \(\) const override](#)

Additional Inherited Members

5.31.1 Detailed Description

A class of directional lights.

5.31.2 Constructor & Destructor Documentation

5.31.2.1 DirectionalLight() [1/3]

```
mage::DirectionalLight::DirectionalLight (
    const RGBSpectrum & intensity = RGBSpectrum(1.0f, 1.0f, 1.0f) ) [explicit]
```

Constructs a directional light.

Parameters

| | | |
|----|------------------|--------------------|
| in | <i>intensity</i> | The RGB intensity. |
|----|------------------|--------------------|

5.31.2.2 DirectionalLight() [2/3]

```
mage::DirectionalLight::DirectionalLight (
    const DirectionalLight & light ) [default]
```

Constructs a directional light from the given directional light.

Parameters

| | | |
|----|--------------|---|
| in | <i>light</i> | A reference to the directional light to copy. |
|----|--------------|---|

5.31.2.3 DirectionalLight() [3/3]

```
mage::DirectionalLight::DirectionalLight (
    DirectionalLight && light ) [default]
```

Constructs a directional light by moving the given directional light.

Parameters

| | | |
|----|--------------|---|
| in | <i>light</i> | A reference to the directional light to move. |
|----|--------------|---|

5.31.2.4 ~DirectionalLight()

```
mage::DirectionalLight::~DirectionalLight ( ) [virtual], [default]
```

Destructs this directional light.

5.31.3 Member Function Documentation

5.31.3.1 Clone()

```
UniquePtr< DirectionalLight > mage::DirectionalLight::Clone ( ) const
```

Clones this directional light.

Returns

A pointer to the clone of this directional light.

5.31.3.2 CloneImplementation()

```
UniquePtr< Light > mage::DirectionalLight::CloneImplementation ( ) const [override], [private], [virtual]
```

Clones this directional light.

Returns

A pointer to the clone of this directional light.

Implements [mage::Light](#).

5.31.3.3 operator=() [1/2]

```
DirectionalLight & mage::DirectionalLight::operator= (
    const DirectionalLight & light ) [default]
```

Copies the given directional light to this directional light.

Parameters

| | | |
|----|--------------|---|
| in | <i>light</i> | A reference to the directional light to copy. |
|----|--------------|---|

Returns

A reference to the copy of the given directional light (i.e. this directional light).

5.31.3.4 operator=() [2/2]

```
DirectionalLight & mage::DirectionalLight::operator= (
    DirectionalLight && light ) [default]
```

Moves the given directional light to this directional light.

Parameters

| | | |
|----|--------------|---|
| in | <i>light</i> | A reference to the directional light to move. |
|----|--------------|---|

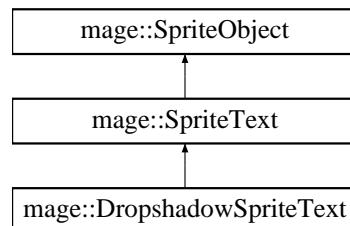
Returns

A reference to the moved directional light (i.e. this directional light).

5.32 mage::DropshadowSpriteText Class Reference

```
#include <dropshadow_sprite_text.hpp>
```

Inheritance diagram for mage::DropshadowSpriteText:



Public Member Functions

- `DropshadowSpriteText (const string &name, SharedPtr< SpriteFont > font, const Color &shadow_color, SpriteEffect effects=SpriteEffect_None)`
- `DropshadowSpriteText (const string &name, SharedPtr< SpriteFont > font, const XMVECTOR &shadow_color=Colors::Black, SpriteEffect effects=SpriteEffect_None)`
- `DropshadowSpriteText (const DropshadowSpriteText &sprite_text)`
- `DropshadowSpriteText (DropshadowSpriteText &&sprite_text)`
- `virtual ~DropshadowSpriteText ()`
- `DropshadowSpriteText & operator= (const DropshadowSpriteText &sprite_text)=delete`
- `DropshadowSpriteText & operator= (DropshadowSpriteText &&sprite_text)=delete`
- `UniquePtr< DropshadowSpriteText > Clone () const`
- `virtual void Draw (SpriteBatch &sprite_batch) const override`
- `const Color GetShadowColor () const`
- `void SetShadowColor (const Color &color)`
- `void SetShadowColor (const XMVECTOR &color)`

Private Member Functions

- `virtual UniquePtr< SpriteObject > ClonelImplementation () const override`
- `const XMVECTOR GetShadowColorVector () const`

Private Attributes

- `Color m_shadow_color`

Additional Inherited Members

5.32.1 Detailed Description

A class of dropshadow sprite texts.

5.32.2 Constructor & Destructor Documentation

5.32.2.1 DropshadowSpriteText() [1/4]

```
mage::DropshadowSpriteText::DropshadowSpriteText (
    const string & name,
    SharedPtr< SpriteFont > font,
    const Color & shadow_color,
    SpriteEffect effects = SpriteEffect_None ) [explicit]
```

Constructs a dropshadow sprite text.

Precondition

`font.get()` is not equal to `nullptr`.

Parameters

| | | |
|----|---------------------------|----------------------------------|
| in | <code>name</code> | The name. |
| in | <code>font</code> | A pointer to the sprite font. |
| in | <code>shadow_color</code> | A reference to the shadow color. |
| in | <code>effects</code> | The sprite effects to apply. |

5.32.2.2 DropshadowSpriteText() [2/4]

```
mage::DropshadowSpriteText::DropshadowSpriteText (
    const string & name,
    SharedPtr< SpriteFont > font,
    const XMVECTOR & shadow_color = Colors::Black,
    SpriteEffect effects = SpriteEffect_None ) [explicit]
```

Constructs a dropshadow sprite text.

Precondition

`font.get()` is not equal to `nullptr`.

Parameters

| | | |
|----|---------------------------|----------------------------------|
| in | <code>name</code> | The name. |
| in | <code>font</code> | A pointer to the sprite font. |
| in | <code>shadow_color</code> | A reference to the shadow color. |
| in | <code>effects</code> | The sprite effects to apply. |

5.32.2.3 DropshadowSpriteText() [3 / 4]

```
mage::DropshadowSpriteText::DropshadowSpriteText (
    const DropshadowSpriteText & sprite_text ) [default]
```

Constructs a dropshadow sprite text from the given dropshadow sprite text.

Parameters

| | | |
|----|-------------|--|
| in | sprite_text | A reference to the dropshadow sprite text to copy. |
|----|-------------|--|

5.32.2.4 DropshadowSpriteText() [4 / 4]

```
mage::DropshadowSpriteText::DropshadowSpriteText (
    DropshadowSpriteText && sprite_text ) [default]
```

Constructs a dropshadow sprite text by moving the given dropshadow sprite text.

Parameters

| | | |
|----|-------------|--|
| in | sprite_text | A reference to the dropshadow sprite text to move. |
|----|-------------|--|

5.32.2.5 ~DropshadowSpriteText()

```
mage::DropshadowSpriteText::~DropshadowSpriteText ( ) [virtual], [default]
```

Destructs this dropshadow sprite text.

5.32.3 Member Function Documentation

5.32.3.1 Clone()

```
UniquePtr< DropshadowSpriteText > mage::DropshadowSpriteText::Clone ( ) const
```

Clones this dropshadow sprite text.

Returns

A pointer to the clone of this dropshadow sprite text.

5.32.3.2 ClonImplementation()

```
UniquePtr< SpriteObject > mage::DropshadowSpriteText::CloneImplementation ( ) const [override], [private], [virtual]
```

Clones this dropshadow sprite text.

Returns

A pointer to the clone of this dropshadow sprite text.

Implements [mage::SpriteText](#).

5.32.3.3 Draw()

```
void mage::DropshadowSpriteText::Draw (
    SpriteBatch & sprite_batch ) const [override], [virtual]
```

Draws this dropshadow sprite text.

Parameters

| | | |
|----|---------------------|---|
| in | <i>sprite_batch</i> | A reference to the sprite batch used for rendering this dropshadow sprite text. |
|----|---------------------|---|

Implements [mage::SpriteText](#).

5.32.3.4 GetShadowColor()

```
const Color mage::DropshadowSpriteText::GetShadowColor ( ) const
```

Returns the shadow color of this dropshadow sprite text.

Returns

The shadow color of this dropshadow sprite text.

5.32.3.5 GetShadowColorVector()

```
const XMVECTOR mage::DropshadowSpriteText::GetShadowColorVector ( ) const [private]
```

Returns the shadow color of this dropshadow sprite text as XMVECTOR.

Returns

The shadow color of this dropshadow sprite text as XMVECTOR.

5.32.3.6 operator=() [1/2]

```
DropshadowSpriteText& mage::DropshadowSpriteText::operator= (
    const DropshadowSpriteText & sprite_text ) [delete]
```

Copies the given dropshadow sprite text to this dropshadow sprite text.

Parameters

| | | |
|----|--------------------|--|
| in | <i>sprite_text</i> | A reference to the dropshadow sprite text to copy. |
|----|--------------------|--|

Returns

A reference to the copy of the given dropshadow sprite text (i.e. this dropshadow sprite text).

5.32.3.7 operator=() [2/2]

```
DropshadowSpriteText& mage::DropshadowSpriteText::operator= (
    DropshadowSpriteText && sprite_text ) [delete]
```

Moves the given dropshadow sprite text to this dropshadow sprite text.

Parameters

| | | |
|----|--------------------|--|
| in | <i>sprite_text</i> | A reference to the dropshadow sprite text to move. |
|----|--------------------|--|

Returns

A reference to the moved dropshadow sprite text (i.e. this dropshadow sprite text).

5.32.3.8 SetShadowColor() [1/2]

```
void mage::DropshadowSpriteText::SetShadowColor (
    const Color & color )
```

Sets the shadow color of this dropshadow sprite text to the given color.

Parameters

| | | |
|----|--------------|----------------------------------|
| in | <i>color</i> | A reference to the shadow color. |
|----|--------------|----------------------------------|

5.32.3.9 SetShadowColor() [2/2]

```
void mage::DropshadowSpriteText::SetShadowColor (
    const XMVECTOR & color )
```

Sets the shadow color of this dropshadow sprite text to the given color.

Parameters

| | | |
|----|--------------|----------------------------------|
| in | <i>color</i> | A reference to the shadow color. |
|----|--------------|----------------------------------|

5.32.4 Member Data Documentation

5.32.4.1 m_shadow_color

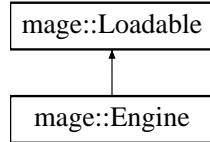
```
Color mage::DropshadowSpriteText::m_shadow_color [private]
```

The shadow color of this dropshadow sprite text.

5.33 mage::Engine Class Reference

```
#include <engine.hpp>
```

Inheritance diagram for mage::Engine:



Public Member Functions

- `Engine (const EngineSetup &setup)`
- `Engine (const Engine &engine)=delete`
- `Engine (Engine &&engine)`
- `virtual ~Engine ()`
- `Engine & operator= (const Engine &engine)=delete`
- `Engine & operator= (Engine &&engine)=delete`
- `void Run (int nCmdShow=SW_NORMAL)`
- `const MainWindow * GetMainWindow () const`
- `void SetDeactiveFlag (bool deactivate)`
- `const Renderer * GetRenderer () const`
- `void SetModeSwitchFlag (bool mode_switch)`
- `const InputManager * GetInputManager () const`
- `ResourceFactory * GetResourceFactory () const`
- `void SetScene (SharedPtr< Scene > scene)`

Private Member Functions

- `void InitializeSystems (const EngineSetup &setup)`

Private Attributes

- `UniquePtr< MainWindow > m_main_window`
- `bool m_deactive`
- `UniquePtr< Renderer > m_renderer`
- `bool m_mode_switch`
- `UniquePtr< InputManager > m_input_manager`
- `UniquePtr< ResourceFactory > m_resource_factory`
- `SharedPtr< Scene > m_scene`
- `UniquePtr< Timer > m_timer`

Additional Inherited Members

5.33.1 Detailed Description

A class of engines.

5.33.2 Constructor & Destructor Documentation

5.33.2.1 Engine() [1/3]

```
mage::Engine::Engine (
    const EngineSetup & setup ) [explicit]
```

Constructs an engine from the given engine setup.

Parameters

| | | |
|----|--------------|---------------------------------|
| in | <i>setup</i> | A reference to an engine setup. |
|----|--------------|---------------------------------|

Exceptions

| | |
|---------------------------|----------------------------------|
| <i>FormattedException</i> | Failed to initialize the engine. |
|---------------------------|----------------------------------|

5.33.2.2 Engine() [2/3]

```
mage::Engine::Engine (
    const Engine & engine ) [delete]
```

Constructs an engine from the given engine.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>engine</i> | A reference to the engine to copy. |
|----|---------------|------------------------------------|

5.33.2.3 Engine() [3/3]

```
mage::Engine::Engine (
    Engine && engine ) [default]
```

Constructs an engine by moving the given engine.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>engine</i> | A reference to the engine to move. |
|----|---------------|------------------------------------|

5.33.2.4 ~Engine()

```
mage::Engine::~Engine ( ) [virtual]
```

Destructs this engine.

5.33.3 Member Function Documentation

5.33.3.1 GetInputManager()

```
const InputManager* mage::Engine::GetInputManager () const
```

Returns the input manager of this engine.

Returns

`nullptr` if this engine is not properly setup.
A pointer to the input manager of this engine.

5.33.3.2 GetMainWindow()

```
const MainWindow* mage::Engine::GetMainWindow () const
```

Returns the main window of this engine.

Returns

`nullptr` if this engine is not properly setup.
A pointer to the main window of this engine.

5.33.3.3 GetRenderer()

```
const Renderer* mage::Engine::GetRenderer () const
```

Returns the renderer of this engine.

Returns

`nullptr` if this engine is not properly setup.
A pointer to the renderer of this engine.

5.33.3.4 GetResourceFactory()

```
ResourceFactory* mage::Engine::GetResourceFactory () const
```

Returns the resource factory of this engine.

Returns

`nullptr` if this engine is not properly setup.
A pointer to the resource factory of this engine.

5.33.3.5 InitializeSystems()

```
void mage::Engine::InitializeSystems (
    const EngineSetup & setup ) [private]
```

Initializes the different systems of this engine.

Parameters

| | | |
|----|--------------|---------------------------------|
| in | <i>setup</i> | A reference to an engine setup. |
|----|--------------|---------------------------------|

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to initialize at least one of the different systems of this engine. |
|---------------------------|--|

5.33.3.6 operator=() [1/2]

```
Engine& mage::Engine::operator= (
    const Engine & engine ) [delete]
```

Copies the given engine to this engine.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>engine</i> | A reference to the engine to copy. |
|----|---------------|------------------------------------|

Returns

A reference to the copy of the given engine (i.e. this engine).

5.33.3.7 operator=() [2/2]

```
Engine& mage::Engine::operator= (
    Engine && engine ) [delete]
```

Copies the given engine to this engine.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>engine</i> | A reference to the engine to move. |
|----|---------------|------------------------------------|

Returns

A reference to the moved engine (i.e. this engine).

5.33.3.8 Run()

```
void mage::Engine::Run (
    int nCmdShow = SW_NORMAL )
```

Runs this engine.

Parameters

| | | |
|----|-----------------|--|
| in | <i>nCmdShow</i> | Controls how the engine window is to be shown. |
|----|-----------------|--|

5.33.3.9 SetDeactiveFlag()

```
void mage::Engine::SetDeactiveFlag (
    bool deactive )
```

Sets the deactivate flag of this engine to the given value.

Parameters

| | | |
|----|-----------------|--|
| in | <i>deactive</i> | The new value for the deactivate flag. |
|----|-----------------|--|

5.33.3.10 SetModeSwitchFlag()

```
void mage::Engine::SetModeSwitchFlag (
    bool mode_switch )
```

Sets the mode switch flag of this engine to the given value.

Parameters

| | | |
|----|--------------------|---|
| in | <i>mode_switch</i> | The new value for the mode switch flag. |
|----|--------------------|---|

5.33.3.11 SetScene()

```
void mage::Engine::SetScene (
    SharedPtr< Scene > scene )
```

Sets the scene of this engine to the given scene.

Returns

A pointer to the scene to set.

5.33.4 Member Data Documentation**5.33.4.1 m_deactive**

```
bool mage::Engine::m_deactive [private]
```

Flag indicating whether the application is active or not.

5.33.4.2 m_input_manager

```
UniquePtr< InputManager > mage::Engine::m_input_manager [private]
```

A pointer to the input manager of this engine.

5.33.4.3 m_main_window

```
UniquePtr< MainWindow > mage::Engine::m_main_window [private]
```

A pointer to the main window of this engine.

5.33.4.4 m_mode_switch

```
bool mage::Engine::m_mode_switch [private]
```

Flag indicating whether the application should switch between full screen and windowed mode.

5.33.4.5 m_renderer

```
UniquePtr< Renderer > mage::Engine::m_renderer [private]
```

A pointer to the renderer of this engine.

5.33.4.6 m_resource_factory

```
UniquePtr< ResourceFactory > mage::Engine::m_resource_factory [private]
```

A pointer to the resource factory of this engine.

5.33.4.7 m_scene

```
SharedPtr< Scene > mage::Engine::m_scene [private]
```

A pointer to the current scene of this engine.

5.33.4.8 m_timer

```
UniquePtr< Timer > mage::Engine::m_timer [private]
```

A pointer to the timer of this engine.

5.34 mage::EngineSetup Struct Reference

```
#include <engine_setup.hpp>
```

Public Member Functions

- virtual ~EngineSetup ()
- EngineSetup & operator= (const EngineSetup &setup)=delete
- EngineSetup & operator= (EngineSetup &&setup)=delete
- const wstring & GetApplicationName () const
- HINSTANCE GetApplicationHinstance () const
- virtual SharedPtr< Scene > CreateScene () const =0

Protected Member Functions

- EngineSetup (HINSTANCE hinstance, const wstring &name=MAGE_DEFAULT_APPLICATION_NAME)
- EngineSetup (const EngineSetup &setup)
- EngineSetup (EngineSetup &&setup)

Private Attributes

- const HINSTANCE m_hinstance
- const wstring m_name

5.34.1 Detailed Description

A struct of engine setups.

5.34.2 Constructor & Destructor Documentation

5.34.2.1 ~EngineSetup()

```
mage::EngineSetup::~EngineSetup ( ) [virtual], [default]
```

Destructs this engine setup.

5.34.2.2 EngineSetup() [1/3]

```
mage::EngineSetup::EngineSetup (
    HINSTANCE hinstance,
    const wstring & name = MAGE_DEFAULT_APPLICATION_NAME ) [explicit], [protected]
```

Constructs an engine setup.

Precondition

hinstance is not equal to `nullptr`.

Parameters

| | | |
|----|------------------|---|
| in | <i>hinstance</i> | The application instance handle of the application. |
| in | <i>name</i> | A reference to the name of the application. |

5.34.2.3 EngineSetup() [2/3]

```
mage::EngineSetup::EngineSetup (
    const EngineSetup & setup ) [protected], [default]
```

Constructs an engine setup from the given engine setup.

Parameters

| | | |
|----|--------------|--|
| in | <i>setup</i> | A reference to the engine setup to copy. |
|----|--------------|--|

5.34.2.4 EngineSetup() [3/3]

```
mage::EngineSetup::EngineSetup (
    EngineSetup && setup ) [protected], [default]
```

Constructs an engine setup by moving the given engine setup.

Parameters

| | | |
|----|--------------|--|
| in | <i>setup</i> | A reference to the engine setup to move. |
|----|--------------|--|

5.34.3 Member Function Documentation

5.34.3.1 CreateScene()

```
virtual SharedPtr< Scene > mage::EngineSetup::CreateScene ( ) const [pure virtual]
```

Creates the first scene of the application.

Returns

A pointer to the first scene of the application.

5.34.3.2 GetApplicationHinstance()

```
HINSTANCE mage::EngineSetup::GetApplicationHinstance ( ) const
```

Returns the application instance handle of the application.

Returns

The application instance handle of the application.

5.34.3.3 GetApplicationName()

```
const wstring& mage::EngineSetup::GetApplicationName ( ) const
```

Returns the name of the application.

Returns

A reference to the name of the application.

5.34.3.4 operator=() [1/2]

```
EngineSetup& mage::EngineSetup::operator= (
    const EngineSetup & setup ) [delete]
```

Copies the given engine setup to this engine setup.

Parameters

| | | |
|----|--------------|---|
| in | <i>setup</i> | A reference to the engine setup to copy from. |
|----|--------------|---|

Returns

A reference to the copy of the given engine setup (i.e. this engine setup).

5.34.3.5 operator=() [2/2]

```
EngineSetup& mage::EngineSetup::operator= (
    EngineSetup && setup ) [delete]
```

Moves the given engine setup to this engine setup.

Parameters

| | | |
|----|--------------|---|
| in | <i>setup</i> | A reference to the engine setup to copy from. |
|----|--------------|---|

Returns

A reference to the moved engine setup (i.e. this engine setup).

5.34.4 Member Data Documentation

5.34.4.1 m_hinstance

```
const HINSTANCE mage::EngineSetup::m_hinstance [private]
```

Application instance handle.

5.34.4.2 m_name

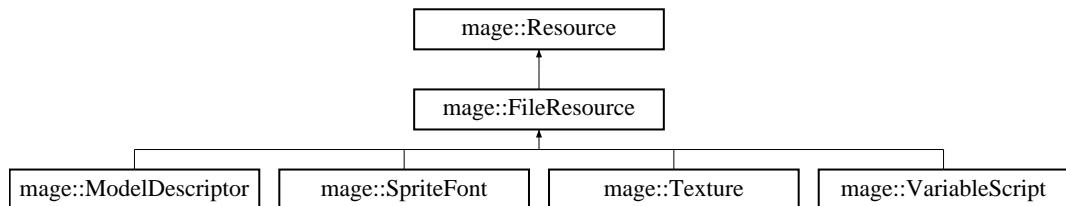
```
const wstring mage::EngineSetup::m_name [private]
```

Name of the application.

5.35 mage::FileResource Class Reference

```
#include <resource.hpp>
```

Inheritance diagram for mage::FileResource:



Public Member Functions

- [FileResource \(const wstring &fname\)](#)
- [FileResource \(const FileResource &file_resource\)=delete](#)
- [FileResource \(FileResource &&file_resource\)](#)
- [virtual ~FileResource \(\)](#)
- [FileResource & operator= \(const FileResource &file_resource\)=delete](#)
- [FileResource & operator= \(FileResource &&file_resource\)=delete](#)
- [const wstring & GetFilename \(\) const](#)
- [const wstring GetName \(\) const](#)
- [const wstring GetPath \(\) const](#)

5.35.1 Detailed Description

A class of file resources.

5.35.2 Constructor & Destructor Documentation

5.35.2.1 FileResource() [1/3]

```
mage::FileResource::FileResource (
    const wstring & fname ) [explicit]
```

Constructs a file resource with a given filename.

Parameters

| | | |
|-----------------|--------------------|------------------------------|
| <code>in</code> | <code>fname</code> | A reference to the filename. |
|-----------------|--------------------|------------------------------|

5.35.2.2 FileResource() [2/3]

```
mage::FileResource::FileResource (
    const FileResource & file_resource ) [delete]
```

Constructs a file resource from the given file resource.

Parameters

| | | |
|-----------------|----------------------------|---|
| <code>in</code> | <code>file_resource</code> | A reference to the file resource to copy. |
|-----------------|----------------------------|---|

5.35.2.3 FileResource() [3/3]

```
mage::FileResource::FileResource (
    FileResource && file_resource ) [default]
```

Constructs a file resource by moving the given file resource.

Parameters

| | | |
|-----------------|----------------------------|---|
| <code>in</code> | <code>file_resource</code> | A reference to the file resource to move. |
|-----------------|----------------------------|---|

5.35.2.4 ~FileResource()

```
mage::FileResource::~FileResource ( ) [virtual], [default]
```

Destructs this file resource.

5.35.3 Member Function Documentation**5.35.3.1 GetFilename()**

```
const wstring& mage::FileResource::GetFilename ( ) const
```

Returns the filename of this file resource.

Returns

A reference to the filename of this file resource.

5.35.3.2 GetName()

```
const wstring mage::FileResource::GetName ( ) const
```

Returns the name of this file resource.

Returns

The name of this file resource.

5.35.3.3 GetPath()

```
const wstring mage::FileResource::GetPath ( ) const
```

Returns the path of this file resource.

Returns

The path of this file resource.

5.35.3.4 operator=() [1/2]

```
FileResource& mage::FileResource::operator= (
    const FileResource & file_resource ) [delete]
```

Copies the given file resource to this file resource.

Parameters

| | | |
|----|----------------------|---|
| in | <i>file_resource</i> | A reference to the file resource to copy. |
|----|----------------------|---|

Returns

A reference to the copy of the given file resource (i.e. this file resource).

5.35.3.5 operator=() [2/2]

```
FileResource& mage::FileResource::operator= (
    FileResource && file_resource ) [delete]
```

Moves the given file resource to this file resource.

Parameters

| | | |
|----|----------------------|---|
| in | <i>file_resource</i> | A reference to the file resource to move. |
|----|----------------------|---|

Returns

A reference to the moved file resource (i.e. this file resource).

5.36 mage::FileStreamCloser Struct Reference

```
#include <memory.hpp>
```

Public Member Functions

- void [operator\(\)](#) (FILE *stream) const

5.36.1 Detailed Description

A struct of file stream destructors (i.e. for closing file streams).

5.36.2 Member Function Documentation

5.36.2.1 operator()()

```
void mage::FileStreamCloser::operator() (
    FILE * stream ) const
```

Destructs the file stream.

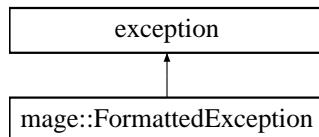
Parameters

| | | |
|----|---------------|---|
| in | <i>stream</i> | A pointer to a file stream to destruct. |
|----|---------------|---|

5.37 mage::FormattedException Struct Reference

```
#include <exception.hpp>
```

Inheritance diagram for mage::FormattedException:



Public Member Functions

- [FormattedException \(\)](#)

- `FormattedException (const char *format,...)`
- `FormattedException (const FormattedException &formatted_exception)`
- `FormattedException (FormattedException &&formatted_exception)`
- `virtual ~FormattedException ()`
- `FormattedException & operator= (const FormattedException &formatted_exception)`
- `FormattedException & operator= (FormattedException &&formatted_exception)`
- `virtual const char * what () const override`

Private Attributes

- `char m_text [2048]`

5.37.1 Detailed Description

A class of formatted exceptions.

5.37.2 Constructor & Destructor Documentation

5.37.2.1 FormattedException() [1/4]

```
mage::FormattedException::FormattedException ( )
```

Constructs a formatted exception.

5.37.2.2 FormattedException() [2/4]

```
mage::FormattedException::FormattedException (
    const char * format,
    ... ) [explicit]
```

Constructs a formatted exception.

Precondition

format is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|--------------------------------|
| in | <i>format</i> | Pointer to the message format. |
|----|---------------|--------------------------------|

5.37.2.3 FormattedException() [3/4]

```
mage::FormattedException::FormattedException (
    const FormattedException & formatted_exception ) [default]
```

Constructs a formatted exception from the given formatted exception.

Parameters

| | | |
|----|----------------------------|---|
| in | <i>formatted_exception</i> | A reference to a formatted exception to copy. |
|----|----------------------------|---|

5.37.2.4 FormattedException() [4/4]

```
mage::FormattedException::FormattedException (
    FormattedException && formatted_exception) [default]
```

Constructs a formatted exception by moving the given formatted exception.

Parameters

| | | |
|----|----------------------------|---|
| in | <i>formatted_exception</i> | A reference to a formatted exception to move. |
|----|----------------------------|---|

5.37.2.5 ~FormattedException()

```
mage::FormattedException::~FormattedException () [virtual], [default]
```

Destructs this formatted exception.

5.37.3 Member Function Documentation**5.37.3.1 operator=() [1/2]**

```
FormattedException & mage::FormattedException::operator= (
    const FormattedException & formatted_exception) [default]
```

Copies the given formatted exception to this formatted exception.

Parameters

| | | |
|----|----------------------------|---|
| in | <i>formatted_exception</i> | A reference to a formatted exception to copy. |
|----|----------------------------|---|

Returns

A reference to the copy of the given formatted exception (i.e. this formatted exception).

5.37.3.2 operator=() [2/2]

```
FormattedException & mage::FormattedException::operator= (
    FormattedException && formatted_exception) [default]
```

Moves the given formatted exception to this formatted exception.

Parameters

| | | |
|----|----------------------------|---|
| in | <i>formatted_exception</i> | A reference to a formatted exception to move. |
|----|----------------------------|---|

Returns

A reference to the moved formatted exception (i.e. this formatted exception).

5.37.3.3 what()

```
virtual const char* mage::FormattedException::what ( ) const [override], [virtual]
```

Returns a null-terminated byte string that may be used to identify the exception.

Returns

A null-terminated byte string that may be used to identify the exception.

5.37.4 Member Data Documentation**5.37.4.1 m_text**

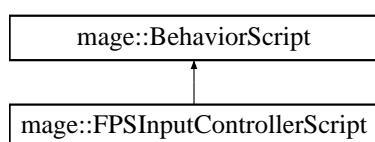
```
char mage::FormattedException::m_text[2048] [private]
```

The text buffer of this formatted exception.

5.38 mage::FPSInputControllerScript Class Reference

```
#include <fps_input_controller_script.hpp>
```

Inheritance diagram for mage::FPSInputControllerScript:

**Public Member Functions**

- [FPSInputControllerScript \(TransformNode *transform\)](#)
- [FPSInputControllerScript \(const FPSInputControllerScript &script\)=delete](#)
- [FPSInputControllerScript \(FPSInputControllerScript &&script\)](#)
- [virtual ~FPSInputControllerScript \(\)](#)
- [FPSInputControllerScript & operator= \(const FPSInputControllerScript &script\)=delete](#)
- [FPSInputControllerScript & operator= \(FPSInputControllerScript &&script\)=delete](#)
- [virtual void Update \(double delta_time\) override](#)

Private Attributes

- UniquePtr< MouseLookScript > m_orientation_script
- UniquePtr< CharacterMotorScript > m_movement_script

Additional Inherited Members

5.38.1 Constructor & Destructor Documentation

5.38.1.1 `FPSInputControllerScript()` [1/3]

```
mage::FPSInputControllerScript::FPSInputControllerScript (
    TransformNode * transform ) [explicit]
```

5.38.1.2 `FPSInputControllerScript()` [2/3]

```
mage::FPSInputControllerScript::FPSInputControllerScript (
    const FPSInputControllerScript & script ) [delete]
```

5.38.1.3 `FPSInputControllerScript()` [3/3]

```
mage::FPSInputControllerScript::FPSInputControllerScript (
    FPSInputControllerScript && script ) [default]
```

5.38.1.4 `~FPSInputControllerScript()`

```
mage::FPSInputControllerScript::~FPSInputControllerScript () [virtual], [default]
```

5.38.2 Member Function Documentation

5.38.2.1 `operator=()` [1/2]

```
FPSInputControllerScript& mage::FPSInputControllerScript::operator= (
    const FPSInputControllerScript & script ) [delete]
```

5.38.2.2 `operator=()` [2/2]

```
FPSInputControllerScript& mage::FPSInputControllerScript::operator= (
    FPSInputControllerScript && script ) [delete]
```

5.38.2.3 `Update()`

```
virtual void mage::FPSInputControllerScript::Update (
    double delta_time ) [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.38.3 Member Data Documentation

5.38.3.1 m_movement_script

```
UniquePtr< CharacterMotorScript > mage::FPSInputControllerScript::m_movement_script [private]
```

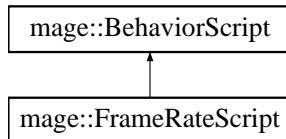
5.38.3.2 m_orientation_script

```
UniquePtr< MouseLookScript > mage::FPSInputControllerScript::m_orientation_script [private]
```

5.39 mage::FrameRateScript Class Reference

```
#include <frame_rate_script.hpp>
```

Inheritance diagram for mage::FrameRateScript:



Public Member Functions

- [FrameRateScript \(SharedPtr< SpriteText > text\)](#)
- [FrameRateScript \(const FrameRateScript &script\)=delete](#)
- [FrameRateScript \(FrameRateScript &&script\)](#)
- [virtual ~FrameRateScript \(\)](#)
- [FrameRateScript & operator= \(const FrameRateScript &script\)=delete](#)
- [FrameRateScript & operator= \(FrameRateScript &&script\)=delete](#)
- [virtual void Update \(double delta_time\) override](#)
- [SpriteText * GetTransform \(\)](#)
- [const SpriteText * GetTransform \(\) const](#)

Static Public Attributes

- static const double [resource_fetch_period = 1.00](#)

Private Attributes

- double `m_accumulated_time`
- uint32_t `m_accumulated_nb_frames`
- uint32_t `m_last_frames_per_second`
- `SharedPtr< SpriteText > m_text`

Additional Inherited Members

5.39.1 Constructor & Destructor Documentation

5.39.1.1 `FrameRateScript()` [1/3]

```
mage::FrameRateScript::FrameRateScript (
    SharedPtr< SpriteText > text ) [explicit]
```

5.39.1.2 `FrameRateScript()` [2/3]

```
mage::FrameRateScript::FrameRateScript (
    const FrameRateScript & script ) [delete]
```

5.39.1.3 `FrameRateScript()` [3/3]

```
mage::FrameRateScript::FrameRateScript (
    FrameRateScript && script ) [default]
```

5.39.1.4 `~FrameRateScript()`

```
mage::FrameRateScript::~FrameRateScript ( ) [virtual], [default]
```

5.39.2 Member Function Documentation

5.39.2.1 `GetTransform()` [1/2]

```
SpriteText* mage::FrameRateScript::GetTransform ( )
```

5.39.2.2 `GetTransform()` [2/2]

```
const SpriteText* mage::FrameRateScript::GetTransform ( ) const
```

5.39.2.3 `operator=()` [1/2]

```
FrameRateScript& mage::FrameRateScript::operator= (
    const FrameRateScript & script ) [delete]
```

5.39.2.4 operator=() [2/2]

```
FrameRateScript& mage::FrameRateScript::operator= (
    FrameRateScript && script ) [delete]
```

5.39.2.5 Update()

```
void mage::FrameRateScript::Update (
    double delta_time ) [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.39.3 Member Data Documentation

5.39.3.1 m_accumulated_nb_frames

```
uint32_t mage::FrameRateScript::m_accumulated_nb_frames [private]
```

5.39.3.2 m_accumulated_time

```
double mage::FrameRateScript::m_accumulated_time [private]
```

5.39.3.3 m_last_frames_per_second

```
uint32_t mage::FrameRateScript::m_last_frames_per_second [private]
```

5.39.3.4 m_text

```
SharedPtr< SpriteText > mage::FrameRateScript::m_text [private]
```

5.39.3.5 resource_fetch_period

```
const double mage::FrameRateScript::resource_fetch_period = 1.00 [static]
```

5.40 mage::Glyph Struct Reference

```
#include <glyph.hpp>
```

Public Member Functions

- `Glyph ()=default`
- `Glyph (const Glyph &glyph)=default`
- `Glyph (Glyph &&glyph)=default`
- `~Glyph ()=default`
- `Glyph & operator= (const Glyph &glyph)=default`
- `Glyph & operator= (Glyph &&glyph)=default`
- `bool operator< (const Glyph &rhs) const`
- `bool operator< (wchar_t rhs) const`

Public Attributes

- `uint32_t m_character`
- `RECT m_sub_rectangle`
- `union {`
- `struct {`
- `float m_offset_x`
- `float m_offset_y`
- `}`
- `float m_offsets [2]`
- `};`
- `float m_advance_x`

5.40.1 Detailed Description

A struct of glyphs.

5.40.2 Constructor & Destructor Documentation

5.40.2.1 `Glyph()` [1/3]

```
mage::Glyph::Glyph ( ) [default]
```

Constructs a glyph.

5.40.2.2 `Glyph()` [2/3]

```
mage::Glyph::Glyph ( const Glyph & glyph ) [default]
```

Constructs a glyph from the given glyph.

Parameters

| | | |
|----|--------------------|-----------------------------------|
| in | <code>glyph</code> | A reference to the glyph to copy. |
|----|--------------------|-----------------------------------|

5.40.2.3 `Glyph()` [3/3]

```
mage::Glyph::Glyph (
    Glyph && glyph ) [default]
```

Constructs a glyph by moving the given glyph.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>glyph</i> | A reference to the glyph to move. |
|----|--------------|-----------------------------------|

5.40.2.4 `~Glyph()`

```
mage::Glyph::~Glyph () [default]
```

Destructs this glyph.

5.40.3 Member Function Documentation

5.40.3.1 `operator<()` [1/2]

```
bool mage::Glyph::operator< (
    const Glyph & rhs ) const
```

Checks whether this glyph's character is smaller than the given glyph's character.

Parameters

| | | |
|----|------------|--|
| in | <i>rhs</i> | A reference to the glyph to compare against. |
|----|------------|--|

Returns

`true` if the this glyph's character is smaller than the given glyph's character. `false` otherwise.

5.40.3.2 `operator<()` [2/2]

```
bool mage::Glyph::operator< (
    wchar_t rhs ) const
```

Checks whether this glyph's character is smaller than the given character.

Parameters

| | | |
|----|------------|-----------------------------------|
| in | <i>rhs</i> | The character to compare against. |
|----|------------|-----------------------------------|

Returns

`true` if the this glyph's character is smaller than the given character. `false` otherwise.

5.40.3.3 operator=() [1/2]

```
Glyph& mage::Glyph::operator= (
    const Glyph & glyph ) [default]
```

Copies the given glyph to this glyph.

Parameters

| | | |
|----|--------------------|-----------------------------------|
| in | <code>glyph</code> | A reference to the glyph to copy. |
|----|--------------------|-----------------------------------|

Returns

A reference to copy of the given glyph (i.e. this glyph).

5.40.3.4 operator=() [2/2]

```
Glyph& mage::Glyph::operator= (
    Glyph && glyph ) [default]
```

Moves the given glyph to this glyph.

Parameters

| | | |
|----|--------------------|-----------------------------------|
| in | <code>glyph</code> | A reference to the glyph to move. |
|----|--------------------|-----------------------------------|

Returns

A reference to the moved glyph (i.e. this glyph).

5.40.4 Member Data Documentation**5.40.4.1 "@1**

```
union { ... }
```

5.40.4.2 m_advance_x

```
float mage::Glyph::m_advance_x
```

The offset of this glyph to the right.

5.40.4.3 m_character

```
uint32_t mage::Glyph::m_character
```

The character of this glyph.

5.40.4.4 m_offset_x

```
float mage::Glyph::m_offset_x
```

The offset of this glyph from the left.

5.40.4.5 m_offset_y

```
float mage::Glyph::m_offset_y
```

The offset of this glyph from the top.

5.40.4.6 m_offsets

```
float mage::Glyph::m_offsets[2]
```

The offsets of this glyph.

5.40.4.7 m_sub_rectangle

```
RECT mage::Glyph::m_sub_rectangle
```

The subrectangle of this glyph.

5.41 mage::GlyphLessThan Struct Reference

Public Member Functions

- [GlyphLessThan \(\)=default](#)
- [GlyphLessThan \(const GlyphLessThan &comparator\)=default](#)
- [GlyphLessThan \(GlyphLessThan &&comparator\)=default](#)
- [~GlyphLessThan \(\)=default](#)
- [GlyphLessThan & operator= \(const GlyphLessThan &comparator\)=default](#)
- [GlyphLessThan & operator= \(GlyphLessThan &&comparator\)=default](#)
- [bool operator\(\) \(const Glyph &lhs, const Glyph &rhs\)](#)
- [bool operator\(\) \(const Glyph &lhs, wchar_t rhs\)](#)
- [bool operator\(\) \(wchar_t lhs, const Glyph &rhs\)](#)

5.41.1 Detailed Description

A struct of glyph "less than" comparators.

5.41.2 Constructor & Destructor Documentation

5.41.2.1 `GlyphLessThan()` [1/3]

```
mage::GlyphLessThan::GlyphLessThan ( ) [default]
```

Constructs a glyph "less than" comparator.

5.41.2.2 `GlyphLessThan()` [2/3]

```
mage::GlyphLessThan::GlyphLessThan (
    const GlyphLessThan & comparator ) [default]
```

Constructs a glyph "less than" comparator from the given glyph "less than" comparator.

Parameters

| | | |
|-----------------|-------------------------|--|
| <code>in</code> | <code>comparator</code> | A reference to the glyph "less than" comparator to copy. |
|-----------------|-------------------------|--|

5.41.2.3 `GlyphLessThan()` [3/3]

```
mage::GlyphLessThan::GlyphLessThan (
    GlyphLessThan && comparator ) [default]
```

Constructs a glyph "less than" comparator by moving the given glyph "less than" comparator.

Parameters

| | | |
|-----------------|-------------------------|--|
| <code>in</code> | <code>comparator</code> | A reference to the glyph "less than" comparator to move. |
|-----------------|-------------------------|--|

5.41.2.4 `~GlyphLessThan()`

```
mage::GlyphLessThan::~GlyphLessThan ( ) [default]
```

Destructs this glyph "less than" comparator.

5.41.3 Member Function Documentation

5.41.3.1 `operator()()` [1/3]

```
bool mage::GlyphLessThan::operator() (
    const Glyph & lhs,
    const Glyph & rhs )
```

Checks whether the first given glyph's character is smaller than the second given glyph's character.

Parameters

| | | |
|----|------------|----------------------------------|
| in | <i>lhs</i> | A reference to the first glyph. |
| in | <i>rhs</i> | A reference to the second glyph. |

Returns

true if the first given glyph's character is smaller than the second given glyph's character. false otherwise.

5.41.3.2 operator() [2/3]

```
bool mage::GlyphLessThan::operator() (
    const Glyph & lhs,
    wchar_t rhs )
```

Checks whether the given glyph's character is smaller than the given character.

Parameters

| | | |
|----|------------|---------------------------|
| in | <i>lhs</i> | A reference to the glyph. |
| in | <i>rhs</i> | The character. |

Returns

true if the given glyph's character is smaller than the given character. false otherwise.

5.41.3.3 operator() [3/3]

```
bool mage::GlyphLessThan::operator() (
    wchar_t lhs,
    const Glyph & rhs )
```

Checks whether the given character is smaller than the given glyph's character.

Parameters

| | | |
|----|------------|---------------------------|
| in | <i>lhs</i> | The character. |
| in | <i>rhs</i> | A reference to the glyph. |

Returns

true if the given character is smaller than the given glyph's character. false otherwise.

5.41.3.4 operator=() [1/2]

```
GlyphLessThan& mage::GlyphLessThan::operator= (
    const GlyphLessThan & comparator ) [default]
```

Copies the given glyph "less than" comparator to this glyph "less than" comparator.

Parameters

| | | |
|-----------------|-------------------------|--|
| <code>in</code> | <code>comparator</code> | A reference to the glyph "less than" comparator to copy. |
|-----------------|-------------------------|--|

Returns

A reference to the copy of the given "less than" comparator (i.e. this "less than" comparator).

5.41.3.5 operator=() [2/2]

```
GlyphLessThan& mage::GlyphLessThan::operator= (
    GlyphLessThan && comparator ) [default]
```

Moves the given glyph "less than" comparator to this glyph "less than" comparator.

Parameters

| | | |
|-----------------|-------------------------|--|
| <code>in</code> | <code>comparator</code> | A reference to the glyph "less than" comparator to move. |
|-----------------|-------------------------|--|

Returns

A reference to the moved "less than" comparator (i.e. this "less than" comparator).

5.42 mage::HandleClosers Struct Reference

```
#include <memory.hpp>
```

Public Member Functions

- `void operator() (HANDLE handle) const`

5.42.1 Detailed Description

A struct of handle destructors (i.e. for closing handles).

5.42.2 Member Function Documentation**5.42.2.1 operator()()**

```
void mage::HandleClosers::operator() (
    HANDLE handle ) const
```

Destructs the given handle.

Parameters

| | | |
|----|---------------|-------------------------|
| in | <i>handle</i> | The handle to destruct. |
|----|---------------|-------------------------|

5.43 mage::IdGenerator Struct Reference

```
#include <id_generator.hpp>
```

Public Member Functions

- [IdGenerator \(int32_t first_id=0\)](#)
- [IdGenerator \(const IdGenerator &id_generator\)=delete](#)
- [IdGenerator \(IdGenerator &&id_generator\)=default](#)
- [~IdGenerator \(\)=default](#)
- [IdGenerator & operator= \(const IdGenerator &id_generator\)=delete](#)
- [IdGenerator & operator= \(IdGenerator &&id_generator\)=delete](#)
- [int32_t GetNextId \(\)](#)

Private Attributes

- [AtomicInt32 m_current_id](#)

5.43.1 Detailed Description

A struct of id generators.

5.43.2 Constructor & Destructor Documentation

5.43.2.1 IdGenerator() [1/3]

```
mage::IdGenerator::IdGenerator (
    int32_t first_id = 0 ) [explicit]
```

Constructs an id generator.

Parameters

| | | |
|----|-----------------|-----------------------------------|
| in | <i>first_id</i> | The first id of this id_generator |
|----|-----------------|-----------------------------------|

5.43.2.2 IdGenerator() [2/3]

```
mage::IdGenerator::IdGenerator (
    const IdGenerator & id_generator ) [delete]
```

Constructs an id generator from the given id generator.

Parameters

| | | |
|----|---------------------|--|
| in | <i>id_generator</i> | A reference to the id generator to copy. |
|----|---------------------|--|

5.43.2.3 IdGenerator() [3/3]

```
mage::IdGenerator::IdGenerator (
    IdGenerator && id_generator ) [default]
```

Constructs an id generator by moving the given id generator.

Parameters

| | | |
|----|---------------------|--|
| in | <i>id_generator</i> | A reference to the id generator to move. |
|----|---------------------|--|

5.43.2.4 ~IdGenerator()

```
mage::IdGenerator::~IdGenerator () [default]
```

Destructs this id generator.

5.43.3 Member Function Documentation

5.43.3.1 GetNextId()

```
int32_t mage::IdGenerator::GetNextId ()
```

Returns the next id of this id generator.

Returns

The next id of this id generator.

5.43.3.2 operator=() [1/2]

```
IdGenerator& mage::IdGenerator::operator=
    const IdGenerator & id_generator ) [delete]
```

Copies the given id generator to this id generator.

Parameters

| | | |
|----|---------------------|---------------------------|
| in | <i>id_generator</i> | The id generator to copy. |
|----|---------------------|---------------------------|

Returns

A reference to the copy of the given id generator (i.e. this id generator).

5.43.3.3 operator=() [2/2]

```
IdGenerator& mage::IdGenerator::operator= (
    IdGenerator && id_generator ) [delete]
```

Copies the given id generator to this id generator.

Parameters

| | | |
|----|---------------------|---------------------------|
| in | <i>id_generator</i> | The id generator to move. |
|----|---------------------|---------------------------|

Returns

A reference to the moved id generator (i.e. this id generator).

5.43.4 Member Data Documentation**5.43.4.1 m_current_id**

```
AtomicInt32 mage::IdGenerator::m_current_id [private]
```

The current id of this id generator.

5.44 mage::InputManager Class Reference

```
#include <input_manager.hpp>
```

Public Member Functions

- [InputManager \(HWND hwindow\)](#)
- [InputManager \(const InputManager &input_manager\)=delete](#)
- [InputManager \(InputManager &&input_manager\)](#)
- [~InputManager \(\)](#)
- [InputManager & operator= \(const InputManager &input_manager\)=delete](#)
- [InputManager & operator= \(InputManager &&input_manager\)=delete](#)
- [void Update \(\)](#)
- [const Keyboard * GetKeyboard \(\) const](#)
- [const Mouse * GetMouse \(\) const](#)

Private Member Functions

- [void InitializeDI \(\)](#)
- [void InitializeInputSystems \(\)](#)

Private Attributes

- const HWND `m_hwindow`
- ComPtr< IDirectInput8 > `m_di`
- UniquePtr< Keyboard > `m_keyboard`
- UniquePtr< Mouse > `m_mouse`

5.44.1 Detailed Description

A class of input managers.

5.44.2 Constructor & Destructor Documentation

5.44.2.1 InputManager() [1/3]

```
mage::InputManager::InputManager (
    HWND hwindow ) [explicit]
```

Constructs an input manager for the given window handle.

Precondition

`hwindow` is not equal to `nullptr`.

Parameters

| | | |
|----|----------------------|----------------------------------|
| in | <code>hwindow</code> | The handle of the parent window. |
|----|----------------------|----------------------------------|

Exceptions

| | |
|---------------------------------|--|
| <code>FormattedException</code> | Failed to initialize the DirectInput object. |
| <code>FormattedException</code> | Failed to initialize the input systems. |

5.44.2.2 InputManager() [2/3]

```
mage::InputManager::InputManager (
    const InputManager & input_manager ) [delete]
```

Constructs an input manager from the given input manager.

Parameters

| | | |
|----|----------------------------|---|
| in | <code>input_manager</code> | A reference to the input manager to copy. |
|----|----------------------------|---|

5.44.2.3 InputManager() [3/3]

```
mage::InputManager::InputManager (
    InputManager && input_manager ) [default]
```

Constructs an input manager by moving the given input manager.

Parameters

| | | |
|----|----------------------|---|
| in | <i>input_manager</i> | A reference to the input manager to move. |
|----|----------------------|---|

5.44.2.4 ~InputManager()

```
mage::InputManager::~InputManager () [default]
```

Destructs this input manager.

5.44.3 Member Function Documentation

5.44.3.1 GetKeyboard()

```
const Keyboard* mage::InputManager::GetKeyboard () const
```

Returns the keyboard of this input manager.

Returns

A pointer to the keyboard of this input manager.

5.44.3.2 GetMouse()

```
const Mouse* mage::InputManager::GetMouse () const
```

Returns the mouse of this input manager.

Returns

A pointer to the mouse of this input manager.

5.44.3.3 InitializeDI()

```
void mage::InputManager::InitializeDI () [private]
```

Initializes the DirectInput object of this input manager.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to initialize the DirectInput object. |
|---------------------------|--|

5.44.3.4 InitializeInputSystems()

```
void mage::InputManager::InitializeInputSystems ( ) [private]
```

Initializes the different input systems of this input manager.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to initialize the input systems. |
|---------------------------|---|

5.44.3.5 operator=() [1/2]

```
InputManager& mage::InputManager::operator= (
    const InputManager & input_manager ) [delete]
```

Copies the given input manager to this input manager.

Parameters

| | | |
|----|----------------------|---|
| in | <i>input_manager</i> | A reference to the input manager to copy. |
|----|----------------------|---|

Returns

A reference to the copy of the given input manager (i.e. this input manager).

5.44.3.6 operator=() [2/2]

```
InputManager& mage::InputManager::operator= (
    InputManager && input_manager ) [delete]
```

Moves the given input manager to this input manager.

Parameters

| | | |
|----|----------------------|---|
| in | <i>input_manager</i> | A reference to the input manager to move. |
|----|----------------------|---|

Returns

A reference to the moved input manager (i.e. this input manager).

5.44.3.7 Update()

```
void mage::InputManager::Update ( )
```

Updates the state of the input systems of this input manager.

5.44.4 Member Data Documentation

5.44.4.1 m_di

```
ComPtr< IDirectInput8 > mage::InputManager::m_di [private]
```

A pointer to the DirectInput object of this input manager.

The methods of the IDirectInput8 interface are used to enumerate, create, and retrieve the status of Microsoft DirectInput device.

5.44.4.2 m_hwindow

```
const HWND mage::InputManager::m_hwindow [private]
```

The handle of the parent window of this input manager.

5.44.4.3 m_keyboard

```
UniquePtr< Keyboard > mage::InputManager::m_keyboard [private]
```

A pointer to the keyboard of this input manager.

5.44.4.4 m_mouse

```
UniquePtr< Mouse > mage::InputManager::m_mouse [private]
```

A pointer to the mouse of this input manager.

5.45 mage::Keyboard Class Reference

```
#include <keyboard.hpp>
```

Public Member Functions

- [Keyboard \(HWND hwindow, IDirectInput8 *di\)](#)
- [Keyboard \(const Keyboard &keyboard\)=delete](#)
- [Keyboard \(Keyboard &&keyboard\)](#)
- [~Keyboard \(\)](#)
- [Keyboard & operator= \(const Keyboard &keyboard\)=delete](#)
- [Keyboard & operator= \(Keyboard &&keyboard\)=delete](#)
- [void Update \(\)](#)
- [bool GetKeyPress \(unsigned char key, bool ignore_press_stamp=false\) const](#)

Private Member Functions

- void [InitializeKeyboard \(\)](#)

Private Attributes

- const HWND [m_hwindow](#)
- IDirectInput8 *const [m_di](#)
- ComPtr< IDirectInputDevice8 > [m_keyboard](#)
- uint64_t [m_press_stamp](#)
- unsigned char [m_key_state](#) [256]
- uint64_t [m_key_press_stamp](#) [256]

5.45.1 Detailed Description

A class of keyboards.

5.45.2 Constructor & Destructor Documentation

5.45.2.1 Keyboard() [1/3]

```
mage::Keyboard::Keyboard (
    HWND hwindow,
    IDirectInput8 * di ) [explicit]
```

Constructs a keyboard.

Precondition

hwindow is not equal to `nullptr`.
di is not equal to `nullptr`.

Parameters

| | | |
|----|----------------|-------------------------------------|
| in | <i>hwindow</i> | The handle of the parent window. |
| in | <i>di</i> | A pointer to a direct input object. |

Exceptions

| | |
|------------------------------------|------------------------------------|
| FormattedException | Failed to initialize the keyboard. |
|------------------------------------|------------------------------------|

5.45.2.2 Keyboard() [2/3]

```
mage::Keyboard::Keyboard (
    const Keyboard & keyboard ) [delete]
```

Constructs a keyboard from the given keyboard.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>keyboard</i> | A reference to the keyboard to copy. |
|----|-----------------|--------------------------------------|

5.45.2.3 Keyboard() [3/3]

```
mage::Keyboard::Keyboard (
    Keyboard && keyboard ) [default]
```

Constructs a keyboard by moving the given keyboard.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>keyboard</i> | A reference to the keyboard to move. |
|----|-----------------|--------------------------------------|

5.45.2.4 ~Keyboard()

```
mage::Keyboard::~Keyboard ( ) [default]
```

Destructs this keyboard.

5.45.3 Member Function Documentation**5.45.3.1 GetKeyPress()**

```
bool mage::Keyboard::GetKeyPress (
    unsigned char key,
    bool ignore_press_stamp = false ) const
```

Checks whether the given key of this keyboard is pressed.

Parameters

| | | |
|----|---------------------------|--|
| in | <i>key</i> | The key. |
| in | <i>ignore_press_stamp</i> | Flag indicating whether press stamps should be ignored. Consistent presses will return false when using the press stamp. |

Returns

`true` if the given key of this keyboard is pressed. `false` otherwise.

5.45.3.2 InitializeKeyboard()

```
void mage::Keyboard::InitializeKeyboard ( ) [private]
```

Initializes the keyboard device of this keyboard.

Exceptions

| | |
|---------------------------|------------------------------------|
| <i>FormattedException</i> | Failed to initialize the keyboard. |
|---------------------------|------------------------------------|

5.45.3.3 operator=() [1/2]

```
Keyboard& mage::Keyboard::operator= (
    const Keyboard & keyboard ) [delete]
```

Copies the given keyboard to this keyboard.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>keyboard</i> | A reference to the keyboard to copy. |
|----|-----------------|--------------------------------------|

Returns

A reference to the copy of the given keyboard (i.e. this keyboard).

5.45.3.4 operator=() [2/2]

```
Keyboard& mage::Keyboard::operator= (
    Keyboard && keyboard ) [delete]
```

Moves the given keyboard to this keyboard.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>keyboard</i> | A reference to the keyboard to move. |
|----|-----------------|--------------------------------------|

Returns

A reference to the moved keyboard (i.e. this keyboard).

5.45.3.5 Update()

```
void mage::Keyboard::Update ( )
```

Updates the state of this keyboard.

5.45.4 Member Data Documentation**5.45.4.1 m_di**

```
IDirectInput8* const mage::Keyboard::m_di [private]
```

A pointer to the DirectInput object of this keyboard.

5.45.4.2 m_hwindow

```
const HWND mage::Keyboard::m_hwindow [private]
```

The handle of the parent window of this keyboard.

5.45.4.3 m_key_press_stamp

```
uint64_t mage::Keyboard::m_key_press_stamp[256] [mutable], [private]
```

The key button press stamp of this keyboard.

Stamps the keys pressed in the last frame of this keyboard.

5.45.4.4 m_key_state

```
unsigned char mage::Keyboard::m_key_state[256] [private]
```

The state of the key buttons of this keyboard.

5.45.4.5 m_keyboard

```
ComPtr< IDirectInputDevice8 > mage::Keyboard::m_keyboard [private]
```

A pointer to the DirectInput keyboard device of this keyboard.

5.45.4.6 m_press_stamp

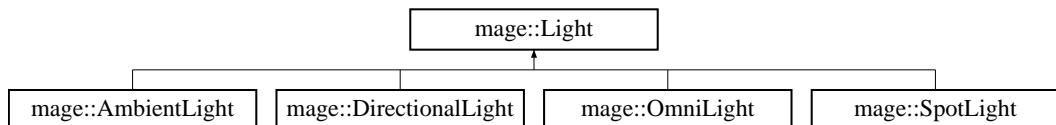
```
uint64_t mage::Keyboard::m_press_stamp [private]
```

The current press stamp (incremented every frame) of this keyboard.

5.46 mage::Light Class Reference

```
#include <light.hpp>
```

Inheritance diagram for mage::Light:



Public Member Functions

- virtual ~Light ()
- Light & operator= (const Light &light)
- Light & operator= (Light &&light)
- UniquePtr< Light > Clone () const
- const RGBSpectrum GetIntensity () const
- void SetIntensity (const RGBSpectrum &intensity)

Protected Member Functions

- Light (const RGBSpectrum &intensity)
- Light (const Light &light)
- Light (Light &&light)

Private Member Functions

- virtual UniquePtr< Light > CloneImplementation () const =0

Private Attributes

- RGBSpectrum m_intensity

5.46.1 Detailed Description

A class of lights.

5.46.2 Constructor & Destructor Documentation

5.46.2.1 ~Light()

```
mage::Light::~Light ( ) [virtual], [default]
```

Destructs this light.

5.46.2.2 Light() [1/3]

```
mage::Light::Light (
    const RGBSpectrum & intensity ) [explicit], [protected]
```

Constructs a light.

Parameters

| | | |
|----|-----------|--------------------|
| in | intensity | The RGB intensity. |
|----|-----------|--------------------|

5.46.2.3 Light() [2/3]

```
mage::Light::Light (
    const Light & light ) [protected], [default]
```

Constructs a light from the given light.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>light</i> | A reference to the light to copy. |
|----|--------------|-----------------------------------|

5.46.2.4 Light() [3/3]

```
mage::Light::Light (
    Light && light ) [protected], [default]
```

Constructs a light by moving the given light.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>light</i> | A reference to the light to move. |
|----|--------------|-----------------------------------|

5.46.3 Member Function Documentation

5.46.3.1 Clone()

```
UniquePtr< Light > mage::Light::Clone ( ) const
```

Clones this light.

Returns

A pointer to the clone of this light.

5.46.3.2 CloneImplementation()

```
virtual UniquePtr< Light > mage::Light::CloneImplementation ( ) const [private], [pure virtual]
```

Clones this light.

Returns

A pointer to the clone of this light.

Implemented in [mage::SpotLight](#), [mage::OmniLight](#), [mage::AmbientLight](#), and [mage::DirectionalLight](#).

5.46.3.3 GetIntensity()

```
const RGBSpectrum mage::Light::GetIntensity () const
```

Returns the intensity of this light.

Returns

The intensity of this light.

5.46.3.4 operator=() [1/2]

```
Light & mage::Light::operator= (
    const Light & light ) [default]
```

Copies the given light to this light.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>light</i> | A reference to the light to copy. |
|----|--------------|-----------------------------------|

Returns

A reference to the copy of the given light (i.e. this light).

5.46.3.5 operator=() [2/2]

```
Light & mage::Light::operator= (
    Light && light ) [default]
```

Moves the given light to this light.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>light</i> | A reference to the light to move. |
|----|--------------|-----------------------------------|

Returns

A reference to the moved light (i.e. this light).

5.46.3.6 SetIntensity()

```
void mage::Light::SetIntensity (
    const RGBSpectrum & intensity )
```

Sets the intensity of this light to the given intensity.

Parameters

| | | |
|----|------------------|-------------------------------|
| in | <i>intensity</i> | A reference to the intensity. |
|----|------------------|-------------------------------|

5.46.4 Member Data Documentation**5.46.4.1 m_intensity**

```
RGBSpectrum mage::Light::m_intensity [private]
```

The intensity of this light.

5.47 mage::Lighting Struct Reference

```
#include <shader.hpp>
```

Public Member Functions

- [Lighting \(\)](#)
- [Lighting \(const Lighting &buffer\)=default](#)
- [Lighting \(Lighting &&buffer\)=default](#)
- [~Lighting \(\)=default](#)
- [Lighting & operator= \(const Lighting &buffer\)=default](#)
- [Lighting & operator= \(Lighting &&buffer\)=default](#)

Public Attributes

- [ID3D11Buffer * m_light_data](#)
- [ID3D11ShaderResourceView * m_omni_lights](#)
- [ID3D11ShaderResourceView * m_spot_lights](#)

5.47.1 Detailed Description

A struct of lighting buffers.

5.47.2 Constructor & Destructor Documentation**5.47.2.1 Lighting() [1/3]**

```
mage::Lighting::Lighting ( )
```

Constructs a lighting buffer.

5.47.2.2 Lighting() [2/3]

```
mage::Lighting::Lighting (
    const Lighting & buffer ) [default]
```

Constructs a lighting buffer from the given lighting buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the lighting buffer to copy. |
|----|--------|---|

5.47.2.3 Lighting() [3/3]

```
mage::Lighting::Lighting (
    Lighting && buffer ) [default]
```

Constructs a lighting buffer by moving the given lighting buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the lighting buffer to move. |
|----|--------|---|

5.47.2.4 ~Lighting()

```
mage::Lighting::~Lighting () [default]
```

Destructs this lighting buffer.

5.47.3 Member Function Documentation**5.47.3.1 operator=() [1/2]**

```
Lighting& mage::Lighting::operator= (
    const Lighting & buffer ) [default]
```

Copies the given lighting buffer to this lighting buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the lighting buffer to copy. |
|----|--------|---|

Returns

A reference to the copy of the given lighting buffer (i.e. this lighting buffer).

5.47.3.2 operator=() [2/2]

```
Lighting& mage::Lighting::operator= (
    Lighting && buffer ) [default]
```

Moves the given lighting buffer to this lighting buffer.

Parameters

| | | |
|-----------------|---------------------|---|
| <code>in</code> | <code>buffer</code> | A reference to the lighting buffer to move. |
|-----------------|---------------------|---|

Returns

A reference to the moved lighting buffer (i.e. this lighting buffer).

5.47.4 Member Data Documentation

5.47.4.1 m_light_data

```
ID3D11Buffer* mage::Lighting::m_light_data
```

A pointer to the light data buffer of this lighting buffer.

5.47.4.2 m_omni_lights

```
ID3D11ShaderResourceView* mage::Lighting::m_omni_lights
```

A pointer to the shader resource view for omni lights of this lighting buffer.

5.47.4.3 m_spot_lights

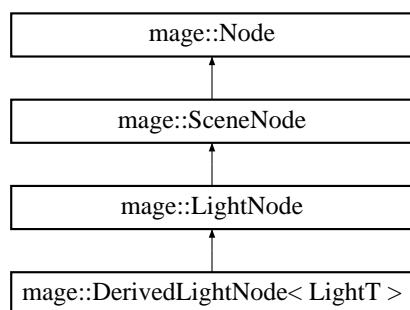
```
ID3D11ShaderResourceView* mage::Lighting::m_spot_lights
```

A pointer to the shader resource view for spotlights of this lighting buffer.

5.48 mage::LightNode Class Reference

```
#include <light_node.hpp>
```

Inheritance diagram for mage::LightNode:



Public Member Functions

- virtual ~LightNode ()
- LightNode & operator= (const LightNode &light_node)=delete
- LightNode & operator= (LightNode &&light_node)=delete
- UniquePtr< LightNode > Clone () const
- Light * GetLight ()
- const Light * GetLight () const

Protected Member Functions

- LightNode (const string &name, UniquePtr< Light > &&light)
- LightNode (const LightNode &light_node)
- LightNode (LightNode &&light_node)

Private Member Functions

- virtual UniquePtr< Node > CloneImplementation () const override=0

Private Attributes

- UniquePtr< Light > m_light

5.48.1 Constructor & Destructor Documentation

5.48.1.1 ~LightNode()

```
mage::LightNode::~LightNode ( ) [virtual], [default]
```

5.48.1.2 LightNode() [1/3]

```
mage::LightNode::LightNode (
    const string & name,
    UniquePtr< Light > && light ) [explicit], [protected]
```

5.48.1.3 LightNode() [2/3]

```
mage::LightNode::LightNode (
    const LightNode & light_node ) [protected]
```

5.48.1.4 LightNode() [3/3]

```
mage::LightNode::LightNode (
    LightNode && light_node ) [protected], [default]
```

5.48.2 Member Function Documentation

5.48.2.1 Clone()

```
UniquePtr< LightNode > mage::LightNode::Clone ( ) const
```

5.48.2.2 ClonImplementation()

```
virtual UniquePtr< Node > mage::LightNode::CloneImplementation ( ) const [override], [private], [pure virtual]
```

Clones this node.

Returns

A pointer to the clone of this node.

Reimplemented from [mage::SceneNode](#).

Implemented in [mage::DerivedLightNode< LightT >](#).

5.48.2.3 GetLight() [1/2]

```
Light* mage::LightNode::GetLight ( )
```

5.48.2.4 GetLight() [2/2]

```
const Light* mage::LightNode::GetLight ( ) const
```

5.48.2.5 operator=() [1/2]

```
LightNode& mage::LightNode::operator= (
    const LightNode & light_node ) [delete]
```

5.48.2.6 operator=() [2/2]

```
LightNode& mage::LightNode::operator= (
    LightNode && light_node ) [delete]
```

5.48.3 Member Data Documentation

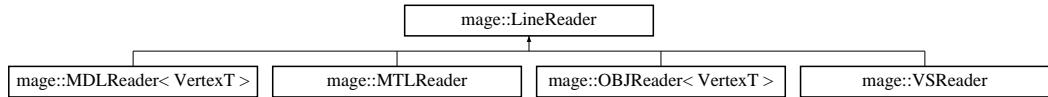
5.48.3.1 m_light

```
UniquePtr< Light > mage::LightNode::m_light [private]
```

5.49 mage::LineReader Class Reference

```
#include <line_reader.hpp>
```

Inheritance diagram for mage::LineReader:



Public Member Functions

- `virtual ~LineReader ()`
- `LineReader & operator= (const LineReader &reader)=delete`
- `LineReader & operator= (LineReader &&reader)=delete`
- `void ReadFromFile (const wstring &fname, const string &delimiters=mage_default_delimiters)`
- `void ReadFromMemory (const char *input, const string &delimiters=mage_default_delimiters)`
- `const wstring & GetFilename () const`
- `const string & GetDelimiters () const`

Protected Member Functions

- `LineReader ()`
- `LineReader (const LineReader &reader)=delete`
- `LineReader (LineReader &&reader)`
- `uint32_t GetCurrentLineNumber () const`
- `void ReadLineRemaining ()`
- `const char * ReadChars ()`
- `const string ReadString ()`
- `const string ReadQuotedString ()`
- `bool ReadBool ()`
- `int8_t ReadInt8 ()`
- `uint8_t ReadUInt8 ()`
- `int16_t ReadInt16 ()`
- `uint16_t ReadUInt16 ()`
- `int32_t ReadInt32 ()`
- `uint32_t ReadUInt32 ()`
- `int64_t ReadInt64 ()`
- `uint64_t ReadUInt64 ()`
- `float ReadFloat ()`
- `double ReadDouble ()`
- `const XMFLOAT2 ReadFloat2 ()`
- `const XMFLOAT3 ReadFloat3 ()`
- `const XMFLOAT4 ReadFloat4 ()`
- `bool HasChars () const`
- `bool HasString () const`
- `bool HasQuotedString () const`
- `bool HasBool () const`
- `bool HasInt8 () const`
- `bool HasUInt8 () const`
- `bool HasInt16 () const`

- bool `HasUInt16 () const`
- bool `HasInt32 () const`
- bool `HasUInt32 () const`
- bool `HasInt64 () const`
- bool `HasUInt64 () const`
- bool `HasFloat () const`
- bool `HasDouble () const`

Protected Attributes

- char * `m_context`

Private Member Functions

- virtual void `Preprocess ()`
- virtual void `ReadLine (char *line)=0`
- virtual void `Postprocess ()`

Private Attributes

- `UniqueFileStream m_file_stream`
- `wstring m_fname`
- `string m_delimiters`
- `uint32_t m_line_number`

5.49.1 Detailed Description

A class of line readers for reading (non-binary) text files line by line.

5.49.2 Constructor & Destructor Documentation

5.49.2.1 `~LineReader()`

```
mage::LineReader::~LineReader ( ) [virtual], [default]
```

Destructs this line reader.

5.49.2.2 `LineReader()` [1/3]

```
mage::LineReader::LineReader ( ) [protected]
```

Constructs a line reader.

5.49.2.3 `LineReader()` [2/3]

```
mage::LineReader::LineReader (
    const LineReader & reader ) [protected], [delete]
```

Constructs a line reader from the given line reader.

Parameters

| | | |
|----|--------|---|
| in | reader | A reference to the line reader to copy. |
|----|--------|---|

5.49.2.4 LineReader() [3/3]

```
mage::LineReader::LineReader (
    LineReader && reader ) [protected], [default]
```

Constructs a line reader by moving the given line reader.

Parameters

| | | |
|----|--------|---|
| in | reader | A reference to the line reader to move. |
|----|--------|---|

5.49.3 Member Function Documentation**5.49.3.1 GetCurrentLineNumber()**

```
uint32_t mage::LineReader::GetCurrentLineNumber ( ) const [protected]
```

Returns the current line number of this line reader.

Returns

The current line number of this line reader.

5.49.3.2 GetDelimiters()

```
const string& mage::LineReader::GetDelimiters ( ) const
```

Returns the current delimiters of this line reader.

Returns

A reference to the current delimiters of this line reader.

5.49.3.3 GetFilename()

```
const wstring& mage::LineReader::GetFilename ( ) const
```

Returns the current filename of this line reader.

Returns

A reference to the current filename of this line reader.

5.49.3.4 HasBool()

```
bool mage::LineReader::HasBool () const [protected]
```

Checks whether the next token of this line reader is a `bool`.

Returns

`true` if the next token of this line reader is a `bool`. `false` otherwise.

5.49.3.5 HasChars()

```
bool mage::LineReader::HasChars () const [protected]
```

Checks whether this line reader has a next token.

Returns

`true` if this line reader has a next token. `false` otherwise.

5.49.3.6 HasDouble()

```
bool mage::LineReader::HasDouble () const [protected]
```

Checks whether the next token of this line reader is a `double`.

Returns

`true` if the next token of this line reader is a `double`. `false` otherwise.

5.49.3.7 HasFloat()

```
bool mage::LineReader::HasFloat () const [protected]
```

Checks whether the next token of this line reader is a `float`.

Returns

`true` if the next token of this line reader is a `float`. `false` otherwise.

5.49.3.8 HasInt16()

```
bool mage::LineReader::HasInt16 () const [protected]
```

Checks whether the next token of this line reader is a `int16_t`.

Returns

`true` if the next token of this line reader is a `int16_t`. `false` otherwise.

5.49.3.9 HasInt32()

```
bool mage::LineReader::HasInt32 () const [protected]
```

Checks whether the next token of this line reader is a `int32_t`.

Returns

`true` if the next token of this line reader is a `int32_t`. `false` otherwise.

5.49.3.10 HasInt64()

```
bool mage::LineReader::HasInt64 () const [protected]
```

Checks whether the next token of this line reader is a `int64_t`.

Returns

`true` if the next token of this line reader is a `int64_t`. `false` otherwise.

5.49.3.11 HasInt8()

```
bool mage::LineReader::HasInt8 () const [protected]
```

Checks whether the next token of this line reader is a `int8_t`.

Returns

`true` if the next token of this line reader is a `int8_t`. `false` otherwise.

5.49.3.12 HasQuotedString()

```
bool mage::LineReader::HasQuotedString () const [protected]
```

Checks whether the next token of this line reader is a quoted string.

Returns

`true` if the next token of this line reader is a quoted string. `false` otherwise.

5.49.3.13 HasString()

```
bool mage::LineReader::HasString () const [protected]
```

Checks whether the next token of this line reader is a string.

Returns

`true` if the next token of this line reader is a string. `false` otherwise.

5.49.3.14 HasUInt16()

```
bool mage::LineReader::HasUInt16 () const [protected]
```

Checks whether the next token of this line reader is a `uint16_t`.

Returns

`true` if the next token of this line reader is a `uint16_t`. `false` otherwise.

5.49.3.15 HasUInt32()

```
bool mage::LineReader::HasUInt32 () const [protected]
```

Checks whether the next token of this line reader is a `uint32_t`.

Returns

`true` if the next token of this line reader is a `uint32_t`. `false` otherwise.

5.49.3.16 HasUInt64()

```
bool mage::LineReader::HasUInt64 () const [protected]
```

Checks whether the next token of this line reader is a `uint64_t`.

Returns

`true` if the next token of this line reader is a `uint64_t`. `false` otherwise.

5.49.3.17 HasUInt8()

```
bool mage::LineReader::HasUInt8 () const [protected]
```

Checks whether the next token of this line reader is a `uint8_t`.

Returns

`true` if the next token of this line reader is a `uint8_t`. `false` otherwise.

5.49.3.18 operator=() [1/2]

```
LineReader& mage::LineReader::operator= (
    const LineReader & reader ) [delete]
```

Copies the given line reader to this line reader.

Parameters

| | | |
|----|--------|---------------------------------------|
| in | reader | A reference to a line reader to copy. |
|----|--------|---------------------------------------|

Returns

A reference to the copy of the given line reader (i.e. this line reader).

5.49.3.19 operator=() [2/2]

```
LineReader& mage::LineReader::operator= (
    LineReader && reader ) [delete]
```

Moves the given line reader to this line reader.

Parameters

| | | |
|----|--------|---------------------------------------|
| in | reader | A reference to a line reader to move. |
|----|--------|---------------------------------------|

Returns

A reference to the moved line reader (i.e. this line reader).

5.49.3.20 Postprocess()

```
virtual void mage::LineReader::Postprocess ( ) [private], [virtual]
```

Post-processes after reading the current file of this line reader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to finish post-processing successfully. |
|---------------------------|--|

Reimplemented in [mage::OBJReader< VertexT >](#).

5.49.3.21 Preprocess()

```
virtual void mage::LineReader::Preprocess ( ) [private], [virtual]
```

Pre-processes before reading the current file of this line reader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to finish the pre-processing successfully. |
|---------------------------|---|

Reimplemented in [mage::OBJReader< VertexT >](#), and [mage::MDLReader< VertexT >](#).

5.49.3.22 ReadBool()

```
bool mage::LineReader::ReadBool () [protected]
```

Reads and converts the next token of this line reader to a `bool`.

Returns

The `bool` represented by the next token of this line reader.

Exceptions

| | |
|---|---|
| <i>FormattedException</i> | There is no next token or the next token does not represent a <code>bool</code> . |
|---|---|

5.49.3.23 ReadChars()

```
const char * mage::LineReader::ReadChars () [protected]
```

Reads and converts the next token of this line reader to a string.

Returns

The string represented by the next token of this line reader.

Exceptions

| | |
|---|-------------------------|
| <i>FormattedException</i> | There is no next token. |
|---|-------------------------|

5.49.3.24 ReadDouble()

```
double mage::LineReader::ReadDouble () [protected]
```

Reads and converts the next token of this line reader to a `double`.

Returns

The `double` represented by the next token of this line reader.

Exceptions

| | |
|---|---|
| <i>FormattedException</i> | There is no next token or the next token does not represent a <code>double</code> . |
|---|---|

5.49.3.25 ReadFloat()

```
float mage::LineReader::ReadFloat () [protected]
```

Reads and converts the next token of this line reader to a float.

Returns

The float represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | There is no next token or the next token does not represent a float. |
|---------------------------|--|

5.49.3.26 ReadFloat2()

```
const XMFLOAT2 mage::LineReader::ReadFloat2 () [protected]
```

Reads and converts the next token of this line reader to a XMFLOAT2.

Returns

The XMFLOAT2 represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | There is no next token or the next token does not represent a XMFLOAT2. |
|---------------------------|---|

5.49.3.27 ReadFloat3()

```
const XMFLOAT3 mage::LineReader::ReadFloat3 () [protected]
```

Reads and converts the next token of this line reader to a XMFLOAT3.

Returns

The XMFLOAT3 represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | There is no next token or the next token does not represent a XMFLOAT3. |
|---------------------------|---|

5.49.3.28 ReadFloat4()

```
const XMFLOAT4 mage::LineReader::ReadFloat4 () [protected]
```

Reads and converts the next token of this line reader to a XMFLOAT4.

Returns

The XMFLOAT4 represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | There is no next token or the next token does not represent a XMFLOAT4. |
|---------------------------|---|

5.49.3.29 ReadFromFile()

```
void mage::LineReader::ReadFromFile (
    const wstring & fname,
    const string & delimiters = mage_default_delimiters )
```

Reads from the given file.

Parameters

| | | |
|----|-------------------|--|
| in | <i>fname</i> | A reference to the file name. |
| in | <i>delimiters</i> | A reference to a string containing the token delimiters (single characters). |

Exceptions

| | |
|---------------------------|-------------------------------------|
| <i>FormattedException</i> | Failed to read from the given file. |
|---------------------------|-------------------------------------|

5.49.3.30 ReadFromMemory()

```
void mage::LineReader::ReadFromMemory (
    const char * input,
    const string & delimiters = mage_default_delimiters )
```

Reads the input string.

Precondition

input is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------|--|
| in | <i>input</i> | A pointer to the input null-terminated byte string. |
| in | <i>delimiters</i> | A reference to a string containing the token delimiters (single characters). |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read from the given input string. |
|---------------------------|---|

5.49.3.31 ReadInt16()

```
int16_t mage::LineReader::ReadInt16 ( ) [protected]
```

Reads and converts the next token of this line reader to a `int16_t`.

Returns

The `int16_t` represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | There is no next token or the next token does not represent a <code>int16_t</code> . |
|---------------------------|--|

5.49.3.32 ReadInt32()

```
int32_t mage::LineReader::ReadInt32 ( ) [protected]
```

Reads and converts the next token of this line reader to a `int32_t`.

Returns

The `int32_t` represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | There is no next token or the next token does not represent a <code>int32_t</code> . |
|---------------------------|--|

5.49.3.33 ReadInt64()

```
int64_t mage::LineReader::ReadInt64 ( ) [protected]
```

Reads and converts the next token of this line reader to a `int64_t`.

Returns

The `int64_t` represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | There is no next token or the next token does not represent a <code>int64_t</code> . |
|---------------------------|--|

5.49.3.34 ReadInt8()

```
int8_t mage::LineReader::ReadInt8 ( ) [protected]
```

Reads and converts the next token of this line reader to a `int8_t`.

Returns

The `int8_t` represented by the next token of this line reader.

Exceptions

| | |
|---------------------------------|---|
| <code>FormattedException</code> | There is no next token or the next token does not represent a <code>int8_t</code> . |
|---------------------------------|---|

5.49.3.35 ReadLine()

```
virtual void mage::LineReader::ReadLine (
    char * line ) [private], [pure virtual]
```

Reads the given line.

Precondition

`line` is not equal to `nullptr`.

Parameters

| | | |
|----------------------|-------------------|---|
| <code>in, out</code> | <code>line</code> | A pointer to the null-terminated byte string to read. |
|----------------------|-------------------|---|

Exceptions

| | |
|---------------------------------|--------------------------------|
| <code>FormattedException</code> | Failed to read the given line. |
|---------------------------------|--------------------------------|

Implemented in `mage::OBJReader< VertexT >`, `mage::MDLReader< VertexT >`, `mage::VSReader`, and `mage::MTLReader`.

5.49.3.36 ReadLineRemaining()

```
void mage::LineReader::ReadLineRemaining ( ) [protected]
```

Reads the remaining tokens of the current line of this line reader.

5.49.3.37 ReadQuotedString()

```
const string mage::LineReader::ReadQuotedString ( ) [protected]
```

Reads and converts the next token of this line reader to a quoted string.

Returns

The quoted string represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | There is no next token or the next token does not represent a quoted string. |
|---------------------------|--|

5.49.3.38 ReadString()

```
const string mage::LineReader::ReadString () [protected]
```

Reads and converts the next token of this line reader to a string.

Returns

The string represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|-------------------------|
| <i>FormattedException</i> | There is no next token. |
|---------------------------|-------------------------|

5.49.3.39 ReadUInt16()

```
uint16_t mage::LineReader::ReadUInt16 () [protected]
```

Reads and converts the next token of this line reader to a `uint16_t`.

Returns

The `uint16_t` represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | There is no next token or the next token does not represent a <code>uint16_t</code> . |
|---------------------------|---|

5.49.3.40 ReadUInt32()

```
uint32_t mage::LineReader::ReadUInt32 () [protected]
```

Reads and converts the next token of this line reader to a `uint32_t`.

Returns

The `uint32_t` represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | There is no next token or the next token does not represent a <code>uint32_t</code> . |
|---------------------------|---|

5.49.3.41 ReadUInt64()

```
uint64_t mage::LineReader::ReadUInt64 ( ) [protected]
```

Reads and converts the next token of this line reader to a `uint64_t`.

Returns

The `uint64_t` represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | There is no next token or the next token does not represent a <code>uint64_t</code> . |
|---------------------------|---|

5.49.3.42 ReadUInt8()

```
uint8_t mage::LineReader::ReadUInt8 ( ) [protected]
```

Reads and converts the next token of this line reader to a `uint8_t`.

Returns

The `uint8_t` represented by the next token of this line reader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | There is no next token or the next token does not represent a <code>uint8_t</code> . |
|---------------------------|--|

5.49.4 Member Data Documentation

5.49.4.1 m_context

```
char* mage::LineReader::m_context [protected]
```

The current context of this line reader.

5.49.4.2 m_delimiters

```
string mage::LineReader::m_delimiters [private]
```

The current delimiters of this line reader.

5.49.4.3 m_file_stream

```
UniqueFileStream mage::LineReader::m_file_stream [private]
```

A pointer to the file stream of this line reader.

5.49.4.4 m_fname

```
wstring mage::LineReader::m_fname [private]
```

The current filename of this line reader.

5.49.4.5 m_line_number

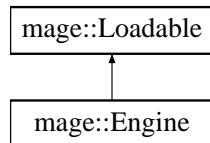
```
uint32_t mage::LineReader::m_line_number [private]
```

The current line number of this line reader.

5.50 mage::Loadable Class Reference

```
#include <loadable.hpp>
```

Inheritance diagram for mage::Loadable:



Public Member Functions

- virtual [~Loadable \(\)](#)
- bool [IsLoaded \(\) const](#)

Protected Member Functions

- [Loadable \(bool loaded=false\)](#)
- [Loadable \(const Loadable &loadable\)](#)
- [Loadable \(Loadable &&loadable\)](#)
- [Loadable & operator= \(const Loadable &loadable\)](#)
- [Loadable & operator= \(Loadable &&loadable\)](#)
- void [SetLoaded \(bool loaded=true\)](#)

Private Attributes

- bool [m_loaded](#)

5.50.1 Detailed Description

A class of loadables.

5.50.2 Constructor & Destructor Documentation

5.50.2.1 ~Loadable()

```
mage::Loadable::~Loadable ( ) [virtual], [default]
```

Destructs this loadable.

5.50.2.2 Loadable() [1/3]

```
mage::Loadable::Loadable (
    bool loaded = false ) [explicit], [protected]
```

Constructs a loadable.

Parameters

| | | |
|----|---------------|---|
| in | <i>loaded</i> | Flag indicating whether the loadable is loaded. |
|----|---------------|---|

5.50.2.3 Loadable() [2/3]

```
mage::Loadable::Loadable (
    const Loadable & loadable ) [protected], [default]
```

Constructs a loadable from the given loadable.

Parameters

| | | |
|----|-----------------|------------------------------|
| in | <i>loadable</i> | A reference to the loadable. |
|----|-----------------|------------------------------|

5.50.2.4 Loadable() [3/3]

```
mage::Loadable::Loadable (
    Loadable && loadable ) [protected], [default]
```

Constructs a loadable by moving the given loadable.

Parameters

| | | |
|----|-----------------|------------------------------|
| in | <i>loadable</i> | A reference to the loadable. |
|----|-----------------|------------------------------|

5.50.3 Member Function Documentation

5.50.3.1 IsLoaded()

```
bool mage::Loadable::IsLoaded ( ) const
```

Checks whether this loadable is loaded.

Returns

`true` if this loadable is loaded. `false` otherwise.

5.50.3.2 operator=() [1/2]

```
Loadable & mage::Loadable::operator= (
    const Loadable & loadable ) [protected], [default]
```

Copies the given loadable to this loadable.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>loadable</i> | A reference to the loadable to copy. |
|----|-----------------|--------------------------------------|

Returns

A reference to the copy of the given loadable (i.e. this loadable).

5.50.3.3 operator=() [2/2]

```
Loadable & mage::Loadable::operator= (
    Loadable && loadable ) [protected], [default]
```

Moves the given loadable to this loadable.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>loadable</i> | A reference to the loadable to move. |
|----|-----------------|--------------------------------------|

Returns

A reference to the moved loadable (i.e. this loadable).

5.50.3.4 SetLoaded()

```
void mage::Loadable::SetLoaded (
    bool loaded = true ) [protected]
```

Set the state of this loadable to the given value.

Parameters

| | | |
|----|---------------|--|
| in | <i>loaded</i> | Flag indicating whether this loadable is loaded. |
|----|---------------|--|

5.50.4 Member Data Documentation

5.50.4.1 m_loaded

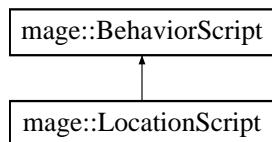
```
bool mage::Loadable::m_loaded [private]
```

Flag indicating whether this loadable is loaded.

5.51 mage::LocationScript Class Reference

```
#include <location_script.hpp>
```

Inheritance diagram for mage::LocationScript:



Public Member Functions

- [LocationScript \(Transform *transform, SharedPtr< SpriteText > text\)](#)
- [LocationScript \(const LocationScript &script\)=delete](#)
- [LocationScript \(LocationScript &&script\)](#)
- virtual [~LocationScript \(\)](#)
- [LocationScript & operator= \(const LocationScript &script\)=delete](#)
- [LocationScript & operator= \(LocationScript &&script\)=delete](#)
- virtual void [Update \(double delta_time\) override](#)

Private Attributes

- [Transform *const m_transform](#)
- [SharedPtr< SpriteText > m_text](#)

Additional Inherited Members

5.51.1 Constructor & Destructor Documentation

5.51.1.1 LocationScript() [1/3]

```
mage::LocationScript::LocationScript (
    Transform * transform,
    SharedPtr< SpriteText > text ) [explicit]
```

5.51.1.2 LocationScript() [2/3]

```
mage::LocationScript::LocationScript (
    const LocationScript & script ) [delete]
```

5.51.1.3 LocationScript() [3/3]

```
mage::LocationScript::LocationScript (
    LocationScript && script ) [default]
```

5.51.1.4 ~LocationScript()

```
mage::LocationScript::~LocationScript () [virtual], [default]
```

5.51.2 Member Function Documentation

5.51.2.1 operator=() [1/2]

```
LocationScript& mage::LocationScript::operator= (
    const LocationScript & script ) [delete]
```

5.51.2.2 operator=() [2/2]

```
LocationScript& mage::LocationScript::operator= (
    LocationScript && script ) [delete]
```

5.51.2.3 Update()

```
void mage::LocationScript::Update (
    double delta_time ) [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.51.3 Member Data Documentation

5.51.3.1 m_text

```
SharedPtr< SpriteText > mage::LocationScript::m_text [private]
```

5.51.3.2 m_transform

```
Transform* const mage::LocationScript::m_transform [private]
```

5.52 mage::LoggingConfiguration Struct Reference

```
#include <logging.hpp>
```

Public Member Functions

- [LoggingConfiguration \(bool quiet=false, bool verbose=false\)](#)
- [LoggingConfiguration \(const LoggingConfiguration &logging_configuration\)=default](#)
- [LoggingConfiguration \(LoggingConfiguration &&logging_configuration\)=default](#)
- [~LoggingConfiguration \(\)=default](#)
- [LoggingConfiguration & operator= \(const LoggingConfiguration &logging_configuration\)=default](#)
- [LoggingConfiguration & operator= \(LoggingConfiguration &&logging_configuration\)=default](#)
- [bool IsQuiet \(\) const](#)
- [bool IsVerbose \(\) const](#)

Private Attributes

- [bool m_quiet](#)
- [bool m_verbose](#)

5.52.1 Detailed Description

A struct of logging configurations of the engine processing.

5.52.2 Constructor & Destructor Documentation

5.52.2.1 LoggingConfiguration() [1/3]

```
mage::LoggingConfiguration::LoggingConfiguration (
    bool quiet = false,
    bool verbose = false ) [explicit]
```

Constructs a new logging configuration.

Parameters

| | | |
|----|----------------|---|
| in | <i>quiet</i> | Flag indicating whether quiet logging is preferred. |
| in | <i>verbose</i> | Flag indicating whether verbose logging is preferred. |

5.52.2.2 LoggingConfiguration() [2/3]

```
mage::LoggingConfiguration::LoggingConfiguration (
    const LoggingConfiguration & logging_configuration ) [default]
```

Constructs a logging configuration from the given logging configuration.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>logging_configuration</i> | A reference to the logging configuration to copy. |
|----|------------------------------|---|

5.52.2.3 LoggingConfiguration() [3/3]

```
mage::LoggingConfiguration::LoggingConfiguration (
    LoggingConfiguration && logging_configuration ) [default]
```

Constructs a logging configuration by moving the given logging configuration.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>logging_configuration</i> | A reference to the logging configuration to move. |
|----|------------------------------|---|

5.52.2.4 ~LoggingConfiguration()

```
mage::LoggingConfiguration::~LoggingConfiguration ( ) [default]
```

Destructs this logging configuration.

5.52.3 Member Function Documentation

5.52.3.1 IsQuiet()

```
bool mage::LoggingConfiguration::IsQuiet ( ) const
```

Checks whether the logging of the engine processing is quiet.

Returns

`true` if the logging of the engine processing is quiet. `false` otherwise.

5.52.3.2 IsVerbose()

```
bool mage::LoggingConfiguration::IsVerbose ( ) const
```

Checks wheter the logging of the engine processing is verbose.

Returns

`true` if the logging of the engine processing is verbose. `false` otherwise.

5.52.3.3 operator=() [1/2]

```
LoggingConfiguration& mage::LoggingConfiguration::operator= (
    const LoggingConfiguration & logging_configuration ) [default]
```

Copies the given logging configuration to this logging configuration.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>logging_configuration</i> | A reference to the logging configuration to copy. |
|----|------------------------------|---|

Returns

A reference to the copy of the given logging configuration (i.e. this logging configuration).

5.52.3.4 operator=() [2/2]

```
LoggingConfiguration& mage::LoggingConfiguration::operator= (
    LoggingConfiguration && logging_configuration ) [default]
```

Moves the given logging configuration to this logging configuration.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>logging_configuration</i> | A reference to the logging configuration to move. |
|----|------------------------------|---|

Returns

A reference to the moved logging configuration (i.e. this logging configuration).

5.52.4 Member Data Documentation

5.52.4.1 m_quiet

```
bool mage::LoggingConfiguration::m_quiet [private]
```

Flag indicating the logging of the engine processing is quiet.

5.52.4.2 m_verbose

```
bool mage::LoggingConfiguration::m_verbose [private]
```

Flag indicating the logging of the engine processing is verbose.

5.53 mage::MainWindow Class Reference

```
#include <main_window.hpp>
```

Public Member Functions

- [MainWindow \(HINSTANCE hinstance, const wstring &name, LONG width, LONG height\)](#)
- [MainWindow \(const MainWindow &main_window\)=delete](#)
- [MainWindow \(MainWindow &&main_window\)](#)
- [~MainWindow \(\)](#)
- [MainWindow & operator= \(const MainWindow &main_window\)=delete](#)
- [MainWindow & operator= \(MainWindow &&main_window\)=delete](#)
- [bool Show \(int nCmdShow\)](#)
- [HINSTANCE GetHinstance \(\)](#)
- [HWND GetHandle \(\)](#)
- [const wstring & GetName \(\) const](#)

Private Member Functions

- [void InitializeWindow \(LONG width, LONG height\)](#)
- [void InitializeWindow \(RECT rectangle\)](#)
- [void UninitializeWindow \(\)](#)

Private Attributes

- [const HINSTANCE m_hinstance](#)
- [HWND m_hwindow](#)
- [const wstring m_name](#)

5.53.1 Detailed Description

A class of application main windows.

5.53.2 Constructor & Destructor Documentation

5.53.2.1 MainWindow() [1/3]

```
mage::MainWindow::MainWindow (
    HINSTANCE hinstance,
    const wstring & name,
    LONG width,
    LONG height ) [explicit]
```

Constructs a main window.

Precondition

hinstance is not equal to `nullptr`.

Parameters

| | | |
|----|------------------|---|
| in | <i>hinstance</i> | The application instance handle. |
| in | <i>name</i> | A reference to the name of the application. |
| in | <i>width</i> | The width of the window. |
| in | <i>height</i> | The height of the window. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to register the main window's class. |
| <i>FormattedException</i> | Failed to create the main window. |

5.53.2.2 MainWindow() [2/3]

```
mage::MainWindow::MainWindow (
    const MainWindow & main_window ) [delete]
```

Constructs a main window from the given main window.

Parameters

| | | |
|----|--------------------|---|
| in | <i>main_window</i> | A reference to the main window to copy. |
|----|--------------------|---|

5.53.2.3 MainWindow() [3/3]

```
mage::MainWindow::MainWindow (
    MainWindow && main_window ) [default]
```

Constructs a main window by moving the given main window.

Parameters

| | | |
|----|--------------------|---|
| in | <i>main_window</i> | A reference to the main window to move. |
|----|--------------------|---|

5.53.2.4 ~MainWindow()

```
mage::MainWindow::~MainWindow ( )
```

Destructs this main window.

5.53.3 Member Function Documentation**5.53.3.1 GetHandle()**

```
HWND mage::MainWindow::GetHandle ( )
```

Returns the window handle of this main window.

Returns

The window handle of this main window.

5.53.3.2 GetHinstance()

```
HINSTANCE mage::MainWindow::GetHinstance ( )
```

Returns the application instance handle of this main window.

Returns

The application instance handle of this main window.

5.53.3.3 GetName()

```
const wstring& mage::MainWindow::GetName ( ) const
```

Returns the name of this main window.

Returns

The name of this main window.

5.53.3.4 InitializeWindow() [1/2]

```
void mage::MainWindow::InitializeWindow (
    LONG width,
    LONG height ) [private]
```

Initializes the engine window of this main window.

Parameters

| | | |
|----|---------------|---|
| in | <i>width</i> | The width of the client rectangle of the window. |
| in | <i>height</i> | The height of the client rectangle of the window. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to register the main window's class. |
| <i>FormattedException</i> | Failed to create the main window. |

5.53.3.5 InitializeWindow() [2/2]

```
void mage::MainWindow::InitializeWindow (
    RECT rectangle ) [private]
```

Initializes the engine window of this main window.

Parameters

| | | |
|----|------------------|-------------------------------------|
| in | <i>rectangle</i> | The client rectangle of the window. |
|----|------------------|-------------------------------------|

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to register the main window's class. |
| <i>FormattedException</i> | Failed to create the main window. |

5.53.3.6 operator=() [1/2]

```
MainWindow& mage::MainWindow::operator= (
    const MainWindow & main_window ) [delete]
```

Copies the given main window to this main window.

Parameters

| | | |
|----|--------------------|---|
| in | <i>main_window</i> | A reference to the main window to copy. |
|----|--------------------|---|

Returns

A reference to the copy of the given main window (i.e. this main window).

5.53.3.7 operator=() [2/2]

```
MainWindow& mage::MainWindow::operator= (
    MainWindow && main_window ) [delete]
```

Moves the given main window to this main window.

Parameters

| | | |
|----|--------------------|---|
| in | <i>main_window</i> | A reference to the main window to move. |
|----|--------------------|---|

Returns

A reference to the moved main window (i.e. this main window).

5.53.3.8 Show()

```
bool mage::MainWindow::Show (
    int nCmdShow )
```

Sets the specified window's show state of this main window.

Parameters

| | | |
|----|-----------------|--|
| in | <i>nCmdShow</i> | Controls how this window is to be shown. |
|----|-----------------|--|

Returns

`true` if the window was previously visible. `false` otherwise.

5.53.3.9 UninitializeWindow()

```
void mage::MainWindow::UninitializeWindow ( ) [private]
```

Uninitializes the engine window of this main window.

5.53.4 Member Data Documentation

5.53.4.1 m_hinstance

```
const HINSTANCE mage::MainWindow::m_hinstance [private]
```

The application instance handle of this main window.

5.53.4.2 m_hwindow

```
HWND mage::MainWindow::m_hwindow [private]
```

The handle of the parent window of this main window.

5.53.4.3 m_name

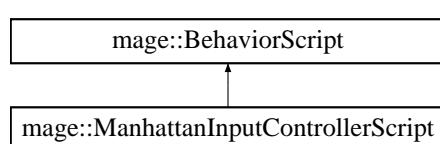
```
const wstring mage::MainWindow::m_name [private]
```

The name of this main window.

5.54 mage::ManhattanInputControllerScript Class Reference

```
#include <manhattan_input_controller_script.hpp>
```

Inheritance diagram for mage::ManhattanInputControllerScript:



Public Member Functions

- `ManhattanInputControllerScript (TransformNode *transform)`
- `ManhattanInputControllerScript (const ManhattanInputControllerScript &script)=delete`
- `ManhattanInputControllerScript (ManhattanInputControllerScript &&script)`
- `virtual ~ManhattanInputControllerScript ()`
- `ManhattanInputControllerScript & operator= (const ManhattanInputControllerScript &script)=delete`
- `ManhattanInputControllerScript & operator= (ManhattanInputControllerScript &&script)=delete`
- `virtual void Update (double delta_time) override`

Private Attributes

- `UniquePtr< MouseLookScript > m_orientation_script`
- `UniquePtr< ManhattanMotorScript > m_movement_script`

Additional Inherited Members

5.54.1 Constructor & Destructor Documentation

5.54.1.1 `ManhattanInputControllerScript()` [1/3]

```
mage::ManhattanInputControllerScript::ManhattanInputControllerScript (
    TransformNode * transform ) [explicit]
```

5.54.1.2 `ManhattanInputControllerScript()` [2/3]

```
mage::ManhattanInputControllerScript::ManhattanInputControllerScript (
    const ManhattanInputControllerScript & script ) [delete]
```

5.54.1.3 `ManhattanInputControllerScript()` [3/3]

```
mage::ManhattanInputControllerScript::ManhattanInputControllerScript (
    ManhattanInputControllerScript && script ) [default]
```

5.54.1.4 `~ManhattanInputControllerScript()`

```
mage::ManhattanInputControllerScript::~ManhattanInputControllerScript ( ) [virtual], [default]
```

5.54.2 Member Function Documentation

5.54.2.1 `operator=()` [1/2]

```
ManhattanInputControllerScript& mage::ManhattanInputControllerScript::operator= (
    const ManhattanInputControllerScript & script ) [delete]
```

5.54.2.2 operator=() [2/2]

```
ManhattanInputControllerScript& mage::ManhattanInputControllerScript::operator= (
    ManhattanInputControllerScript && script ) [delete]
```

5.54.2.3 Update()

```
virtual void mage::ManhattanInputControllerScript::Update (
    double delta_time ) [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.54.3 Member Data Documentation

5.54.3.1 m_movement_script

```
UniquePtr< ManhattanMotorScript > mage::ManhattanInputControllerScript::m_movement_script
[private]
```

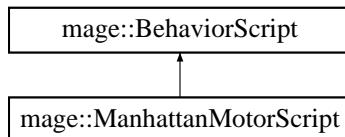
5.54.3.2 m_orientation_script

```
UniquePtr< MouseLookScript > mage::ManhattanInputControllerScript::m_orientation_script [private]
```

5.55 mage::ManhattanMotorScript Class Reference

```
#include <manhattan_motor_script.hpp>
```

Inheritance diagram for mage::ManhattanMotorScript:



Public Member Functions

- [ManhattanMotorScript \(TransformNode *transform\)](#)
- [ManhattanMotorScript \(const \[ManhattanMotorScript\]\(#\) &script\)=delete](#)
- [ManhattanMotorScript \(\[ManhattanMotorScript\]\(#\) &&script\)](#)
- virtual [~ManhattanMotorScript \(\)](#)
- [ManhattanMotorScript & operator= \(const \[ManhattanMotorScript\]\(#\) &script\)=delete](#)
- [ManhattanMotorScript & operator= \(\[ManhattanMotorScript\]\(#\) &&script\)=delete](#)
- virtual void [Update \(double delta_time\)](#) override
- float [GetVelocity \(\) const](#)
- void [SetVelocity \(float velocity\)](#)

Private Attributes

- [TransformNode *const m_transform](#)
- float [m_velocity](#)

Additional Inherited Members

5.55.1 Constructor & Destructor Documentation

5.55.1.1 `ManhattanMotorScript()` [1/3]

```
mage::ManhattanMotorScript::ManhattanMotorScript (
    TransformNode * transform ) [explicit]
```

5.55.1.2 `ManhattanMotorScript()` [2/3]

```
mage::ManhattanMotorScript::ManhattanMotorScript (
    const ManhattanMotorScript & script ) [delete]
```

5.55.1.3 `ManhattanMotorScript()` [3/3]

```
mage::ManhattanMotorScript::ManhattanMotorScript (
    ManhattanMotorScript && script ) [default]
```

5.55.1.4 `~ManhattanMotorScript()`

```
mage::ManhattanMotorScript::~ManhattanMotorScript () [virtual], [default]
```

5.55.2 Member Function Documentation

5.55.2.1 `GetVelocity()`

```
float mage::ManhattanMotorScript::GetVelocity () const
```

5.55.2.2 `operator=()` [1/2]

```
ManhattanMotorScript& mage::ManhattanMotorScript::operator= (
    const ManhattanMotorScript & script ) [delete]
```

5.55.2.3 `operator=()` [2/2]

```
ManhattanMotorScript& mage::ManhattanMotorScript::operator= (
    ManhattanMotorScript && script ) [delete]
```

5.55.2.4 `SetVelocity()`

```
void mage::ManhattanMotorScript::SetVelocity (
    float velocity )
```

5.55.2.5 `Update()`

```
void mage::ManhattanMotorScript::Update (
    double delta_time ) [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.55.3 Member Data Documentation

5.55.3.1 m_transform

```
TransformNode* const mage::ManhattanMotorScript::m_transform [private]
```

5.55.3.2 m_velocity

```
float mage::ManhattanMotorScript::m_velocity [private]
```

5.56 mage::Material Struct Reference

```
#include <material.hpp>
```

Public Member Functions

- [Material \(const string &name\)](#)
- [Material \(const Material &material\)=default](#)
- [Material \(Material &&material\)=default](#)
- [~Material \(\)=default](#)
- [Material & operator= \(const Material &material\)=default](#)
- [Material & operator= \(Material &&material\)=default](#)

Public Attributes

- string [m_name](#)
- [RGBSpectrum m_transmission_filter](#)
- [RGBSpectrum m_ambient_reflectivity](#)
- [SharedPtr< Texture > m_ambient_reflectivity_texture](#)
- [RGBSpectrum m_diffuse_reflectivity](#)
- [SharedPtr< Texture > m_diffuse_reflectivity_texture](#)
- [RGBSpectrum m_specular_reflectivity](#)
- [SharedPtr< Texture > m_specular_reflectivity_texture](#)
- float [m_specular_exponent](#)
- [SharedPtr< Texture > m_specular_exponent_texture](#)
- float [m_dissolve](#)
- [SharedPtr< Texture > m_dissolve_texture](#)
- float [m_index_of_refraction](#)
- [SharedPtr< Texture > m_decal_texture](#)
- [SharedPtr< Texture > m_displacement_texture](#)
- [SharedPtr< Texture > m_bump_texture](#)

5.56.1 Detailed Description

A struct of materials.

5.56.2 Constructor & Destructor Documentation

5.56.2.1 Material() [1/3]

```
mage::Material::Material (
    const string & name ) [explicit]
```

Constructs a material.

Parameters

| | | |
|----|------|--|
| in | name | A reference to the name of the material. |
|----|------|--|

5.56.2.2 Material() [2/3]

```
mage::Material::Material (
    const Material & material ) [default]
```

Constructs a material from the given material.

Parameters

| | | |
|----|----------|--------------------------------------|
| in | material | A reference to the material to copy. |
|----|----------|--------------------------------------|

5.56.2.3 Material() [3/3]

```
mage::Material::Material (
    Material && material ) [default]
```

Constructs a material by moving the given material.

Parameters

| | | |
|----|----------|--------------------------------------|
| in | material | A reference to the material to move. |
|----|----------|--------------------------------------|

5.56.2.4 ~Material()

```
mage::Material::~Material ( ) [default]
```

Destructs this material.

5.56.3 Member Function Documentation

5.56.3.1 operator=() [1/2]

```
Material& mage::Material::operator= (
    const Material & material ) [default]
```

Copies the given material to this material.

Parameters

| | | |
|----|----------|--------------------------------------|
| in | material | A reference to the material to copy. |
|----|----------|--------------------------------------|

Returns

A reference to the copy of the given material (i.e. this material).

5.56.3.2 operator=() [2/2]

```
Material& mage::Material::operator= (
    Material && material ) [default]
```

Moves the given material to this material.

Parameters

| | | |
|----|----------|--------------------------------------|
| in | material | A reference to the material to move. |
|----|----------|--------------------------------------|

Returns

A reference to the moved material (i.e. this material).

5.56.4 Member Data Documentation

5.56.4.1 m_ambient_reflectivity

```
RGBSpectrum mage::Material::m_ambient_reflectivity
```

The ambient reflectivity of this material.

5.56.4.2 m_ambient_reflectivity_texture

```
SharedPtr< Texture > mage::Material::m_ambient_reflectivity_texture
```

A pointer to the ambient reflectivity texture of this material.

5.56.4.3 m_bump_texture

```
SharedPtr< Texture > mage::Material::m_bump_texture
```

A pointer to the bump texture of this material.

5.56.4.4 m_decal_texture

```
SharedPtr< Texture > mage::Material::m_decal_texture
```

A pointer to the decal texture of this material.

5.56.4.5 m_diffuse_reflectivity

```
RGBSpectrum mage::Material::m_diffuse_reflectivity
```

The diffuse reflectivity of this material.

5.56.4.6 m_diffuse_reflectivity_texture

```
SharedPtr< Texture > mage::Material::m_diffuse_reflectivity_texture
```

A pointer to the diffuse reflectivity texture of this material.

5.56.4.7 m_displacement_texture

```
SharedPtr< Texture > mage::Material::m_displacement_texture
```

A pointer to the displacement texture of this material.

5.56.4.8 m_dissolve

```
float mage::Material::m_dissolve
```

The amount this material dissolves into the background.

A factor of 1.0 is fully opaque. A factor of 0.0 is fully dissolved (completely transparent).

Unlike a real transparent material, the dissolve does not depend upon material thickness nor does it have any spectral character.

5.56.4.9 m_dissolve_texture

```
SharedPtr< Texture > mage::Material::m_dissolve_texture
```

A pointer to the dissolve texture of this material.

5.56.4.10 m_index_of_refraction

```
float mage::Material::m_index_of_refraction
```

The index of refraction (optical density) of this material.

5.56.4.11 m_name

```
string mage::Material::m_name
```

The name of this material.

5.56.4.12 m_specular_exponent

```
float mage::Material::m_specular_exponent
```

The specular exponent (surface roughness) of this material.

A high exponent results in a tight, concentrated highlight. Values normally range from 0 to 1000.

5.56.4.13 m_specular_exponent_texture

```
SharedPtr< Texture > mage::Material::m_specular_exponent_texture
```

A pointer to the specular exponent texture of this material.

5.56.4.14 m_specular_reflectivity

```
RGBSpectrum mage::Material::m_specular_reflectivity
```

The specular reflectivity of this material.

5.56.4.15 m_specular_reflectivity_texture

```
SharedPtr< Texture > mage::Material::m_specular_reflectivity_texture
```

A pointer to the specular reflectivity texture of this material.

5.56.4.16 m_transmission_filter

```
RGBSpectrum mage::Material::m_transmission_filter
```

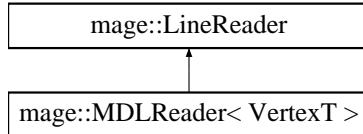
The transmission filter of this material.

Any light passing through the material is filtered by the transmission filter, which only allows the specific colors to pass through.

5.57 mage::MDLReader< VertexT > Class Template Reference

```
#include <mdl_reader.hpp>
```

Inheritance diagram for mage::MDLReader< VertexT >:



Public Member Functions

- [MDLReader \(ModelOutput< VertexT > &model_output\)](#)
- [MDLReader \(const MDLReader &reader\)=delete](#)
- [MDLReader \(MDLReader &&reader\)](#)
- [virtual ~MDLReader \(\)](#)
- [MDLReader & operator= \(const MDLReader &reader\)=delete](#)
- [MDLReader & operator= \(MDLReader &&reader\)=delete](#)

Private Member Functions

- [virtual void Preprocess \(\) override](#)
- [virtual void ReadLine \(char *line\) override](#)
- [void ImportMesh \(\)](#)
- [void ReadMDLSubModel \(\)](#)
- [void ReadMDLMaterialLibrary \(\)](#)

Private Attributes

- [ModelOutput< VertexT > & m_model_output](#)

Additional Inherited Members

5.57.1 Detailed Description

```
template<typename VertexT>
class mage::MDLReader< VertexT >
```

A class of MDL file readers for reading models.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

5.57.2 Constructor & Destructor Documentation

5.57.2.1 `MDLReader()` [1/3]

```
template<typename VertexT >
mage::MDLReader< VertexT >::MDLReader (
    ModelOutput< VertexT > & model_output ) [explicit]
```

Constructs a MDL reader.

Parameters

| | | |
|----|---------------------------|---|
| in | <code>model_output</code> | A reference to the model output for storing the model data from file. |
|----|---------------------------|---|

5.57.2.2 `MDLReader()` [2/3]

```
template<typename VertexT >
mage::MDLReader< VertexT >::MDLReader (
    const MDLReader< VertexT > & reader ) [delete]
```

Constructs a MDL reader from the given MDL reader.

Parameters

| | | |
|----|---------------------|--|
| in | <code>reader</code> | A reference to the MDL reader to copy. |
|----|---------------------|--|

5.57.2.3 `MDLReader()` [3/3]

```
template<typename VertexT >
mage::MDLReader< VertexT >::MDLReader (
    MDLReader< VertexT > && reader )
```

Constructs a MDL reader by moving the given MDL reader.

Parameters

| | | |
|----|---------------------|--|
| in | <code>reader</code> | A reference to the MDL reader to move. |
|----|---------------------|--|

5.57.2.4 `~MDLReader()`

```
template<typename VertexT >
virtual mage::MDLReader< VertexT >::~MDLReader ( ) [virtual]
```

Destructs this MDL reader.

5.57.3 Member Function Documentation

5.57.3.1 ImportMesh()

```
template<typename VertexT >
void mage::MDLReader< VertexT >::ImportMesh ( ) [private]
```

Reads the [Mesh](#) definition and imports the mesh corresponding to the model.

Exceptions

| | |
|------------------------------------|---|
| FormattedException | Failed to read the Mesh definition. |
| FormattedException | Failed to import the mesh. |

5.57.3.2 operator=() [1/2]

```
template<typename VertexT >
MDLReader& mage::MDLReader< VertexT >::operator= (
    const MDLReader< VertexT > & reader ) [delete]
```

Copies the given MDL reader to this MDL reader.

Parameters

| | | |
|----|--------|--------------------------------------|
| in | reader | A reference to a MDL reader to copy. |
|----|--------|--------------------------------------|

Returns

A reference to the copy of the given MDL reader (i.e. this MDL reader).

5.57.3.3 operator=() [2/2]

```
template<typename VertexT >
MDLReader& mage::MDLReader< VertexT >::operator= (
    MDLReader< VertexT > && reader ) [delete]
```

Moves the given MDL reader to this MDL reader.

Parameters

| | | |
|----|--------|--------------------------------------|
| in | reader | A reference to a MDL reader to move. |
|----|--------|--------------------------------------|

Returns

A reference to the moved MDL reader (i.e. this MDL reader).

5.57.3.4 Preprocess()

```
template<typename VertexT >
virtual void mage::MDLReader< VertexT >::Preprocess ( ) [override], [private], [virtual]
```

Pre-processes before reading the current file of this MDL reader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to finish the pre-processing successfully. |
|---------------------------|---|

Reimplemented from [mage::LineReader](#).

5.57.3.5 ReadLine()

```
template<typename VertexT >
virtual void mage::MDLReader< VertexT >::ReadLine (
    char * line ) [override], [private], [virtual]
```

Reads the given line.

Precondition

line is not equal to `nullptr`.

Parameters

| | | |
|----------------|-------------|---|
| <i>in, out</i> | <i>line</i> | A pointer to the null-terminated byte string to read. |
|----------------|-------------|---|

Exceptions

| | |
|---------------------------|--------------------------------|
| <i>FormattedException</i> | Failed to read the given line. |
|---------------------------|--------------------------------|

Implements [mage::LineReader](#).

5.57.3.6 ReadMDLMaterialLibrary()

```
template<typename VertexT >
void mage::MDLReader< VertexT >::ReadMDLMaterialLibrary ( ) [private]
```

Reads a [Material](#) Library definition and imports the materials corresponding to the model.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a Material Library definition. |
| <i>FormattedException</i> | Failed to import the materials. |

5.57.3.7 ReadMDLSubModel()

```
template<typename VertexT >
void mage::MDLReader< VertexT >::ReadMDLSubModel( ) [private]
```

Reads a Submodel definition.

Exceptions

| | |
|---------------------------|---------------------------------------|
| <i>FormattedException</i> | Failed to read a Submodel definition. |
|---------------------------|---------------------------------------|

5.57.4 Member Data Documentation

5.57.4.1 m_model_output

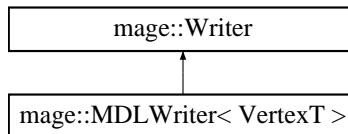
```
template<typename VertexT >
ModelOutput< VertexT >& mage::MDLReader< VertexT >::m_model_output [private]
```

A reference to the model output containing the model data of this MDL reader.

5.58 mage::MDLWriter< VertexT > Class Template Reference

```
#include <mdl_writer.hpp>
```

Inheritance diagram for mage::MDLWriter< VertexT >:



Public Member Functions

- `MDLWriter (const ModelOutput< VertexT > &model_output)`
- `MDLWriter (const MDLWriter &writer)=delete`
- `MDLWriter (MDLWriter &&writer)`
- `virtual ~MDLWriter ()`
- `MDLWriter & operator= (const MDLWriter &writer)=delete`
- `MDLWriter & operator= (MDLWriter &&writer)=delete`

Private Member Functions

- `virtual void Write () override`
- `void ExportMesh ()`
- `void WriteMaterials ()`
- `void WriteModelParts ()`

Private Attributes

- const `ModelOutput< VertexT >` & `m_model_output`

Additional Inherited Members

5.58.1 Detailed Description

```
template<typename VertexT>
class mage::MDLWriter< VertexT >
```

A class of MDL file writers for writing models.

Template Parameters

| | |
|----------------------|------------------|
| <code>VertexT</code> | The vertex type. |
|----------------------|------------------|

5.58.2 Constructor & Destructor Documentation

5.58.2.1 MDLWriter() [1/3]

```
template<typename VertexT >
mage::MDLWriter< VertexT >::MDLWriter (
    const ModelOutput< VertexT > & model_output ) [explicit]
```

Constructs a MDL writer.

Parameters

| | | |
|----|---------------------------|--|
| in | <code>model_output</code> | A reference to the model output containing the model data. |
|----|---------------------------|--|

5.58.2.2 MDLWriter() [2/3]

```
template<typename VertexT >
mage::MDLWriter< VertexT >::MDLWriter (
    const MDLWriter< VertexT > & writer ) [delete]
```

Constructs a MDL writer from the given MDL writer.

Parameters

| | | |
|----|---------------------|--|
| in | <code>writer</code> | A reference to the MDL writer to copy. |
|----|---------------------|--|

5.58.2.3 MDLWriter() [3/3]

```
template<typename VertexT >
mage::MDLWriter< VertexT >::MDLWriter (
    MDLWriter< VertexT > && writer )
```

Constructs a MDL writer by moving the given MDL writer.

Parameters

| | | |
|----|---------------|--|
| in | <i>writer</i> | A reference to the MDL writer to move. |
|----|---------------|--|

5.58.2.4 ~MDLWriter()

```
template<typename VertexT >
virtual mage::MDLWriter< VertexT >::~MDLWriter ( ) [virtual]
```

Destructs this MDL writer.

5.58.3 Member Function Documentation

5.58.3.1 ExportMesh()

```
template<typename VertexT >
void mage::MDLWriter< VertexT >::ExportMesh ( ) [private]
```

Writes and exports the mesh corresponding to the model.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to write. |
| <i>FormattedException</i> | Failed to export the mesh corresponding to the model to file. |

5.58.3.2 operator=() [1/2]

```
template<typename VertexT >
MDLWriter& mage::MDLWriter< VertexT >::operator= (
    const MDLWriter< VertexT > & writer ) [delete]
```

Copies the given MDL writer to this MDL writer.

Parameters

| | | |
|----|---------------|--------------------------------------|
| in | <i>writer</i> | A reference to a MDL writer to copy. |
|----|---------------|--------------------------------------|

Returns

A reference to the copy of the given MDL writer (i.e. this MDL writer).

5.58.3.3 operator=() [2/2]

```
template<typename VertexT >
MDLWriter& mage::MDLWriter< VertexT >::operator= (
    MDLWriter< VertexT > && writer ) [delete]
```

Moves the given MDL writer to this MDL writer.

Parameters

| | | |
|-----------------|---------------------|--------------------------------------|
| <code>in</code> | <code>writer</code> | A reference to a MDL writer to move. |
|-----------------|---------------------|--------------------------------------|

Returns

A reference to the moved MDL writer (i.e. this MDL writer).

5.58.3.4 Write()

```
template<typename VertexT >
virtual void mage::MDLWriter< VertexT >::Write ( ) [override], [private], [virtual]
```

Starts writing.

Exceptions

| | |
|---------------------------------|------------------|
| <code>FormattedException</code> | Failed to write. |
|---------------------------------|------------------|

Implements [mage::Writer](#).

5.58.3.5 WriteMaterials()

```
template<typename VertexT >
void mage::MDLWriter< VertexT >::WriteMaterials ( ) [private]
```

Writes the materials corresponding to the model.

Exceptions

| | |
|---------------------------------|------------------|
| <code>FormattedException</code> | Failed to write. |
|---------------------------------|------------------|

5.58.3.6 WriteModelParts()

```
template<typename VertexT >
```

```
void mage::MDLWriter< VertexT >::WriteModelParts ( ) [private]
```

Writes the model parts corresponding to the model.

Exceptions

| | |
|---------------------------|------------------|
| <i>FormattedException</i> | Failed to write. |
|---------------------------|------------------|

5.58.4 Member Data Documentation

5.58.4.1 m_model_output

```
template<typename VertexT >
const ModelOutput< VertexT >& mage::MDLWriter< VertexT >::m_model_output [private]
```

A reference to the model output containing the model data of this MDL writer.

5.59 mage::MemoryArena Class Reference

```
#include <memory_arena.hpp>
```

Public Member Functions

- [MemoryArena \(size_t block_size=32768\)](#)
- [MemoryArena \(const MemoryArena &arena\)=delete](#)
- [MemoryArena \(MemoryArena &&arena\)](#)
- [~MemoryArena \(\)](#)
- [MemoryArena & operator= \(const MemoryArena &arena\)=delete](#)
- [MemoryArena & operator= \(MemoryArena &&arena\)=delete](#)
- [size_t GetBlockSize \(\) const](#)
- [size_t GetCurrentBlockSize \(\) const](#)
- [size_t GetTotalBlockSize \(\) const](#)
- [char * GetCurrentBlockPtr \(\) const](#)
- [void Reset \(\)](#)
- [void * Alloc \(size_t size\)](#)
- [template<typename DataT > DataT * Alloc \(size_t count=1, bool initialization=true\)](#)

Private Types

- [typedef pair< size_t, char *> MemoryBlock](#)

Private Attributes

- [const size_t m_block_size](#)
- [size_t m_current_block_pos](#)
- [MemoryBlock m_current_block](#)
- [list< MemoryBlock > m_used_blocks](#)
- [list< MemoryBlock > m_available_blocks](#)

5.59.1 Detailed Description

A class of memory arenas.

5.59.2 Member Typedef Documentation

5.59.2.1 MemoryBlock

```
typedef pair< size_t, char * > mage::MemoryArena::MemoryBlock [private]
```

A type definition for a memory block.

5.59.3 Constructor & Destructor Documentation

5.59.3.1 MemoryArena() [1/3]

```
mage::MemoryArena::MemoryArena (
    size_t block_size = 32768 ) [explicit]
```

Constructs a memory arena with given block size.

Parameters

| | | |
|----|------------|----------------------------------|
| in | block_size | The maximum block size in bytes. |
|----|------------|----------------------------------|

5.59.3.2 MemoryArena() [2/3]

```
mage::MemoryArena::MemoryArena (
    const MemoryArena & arena ) [delete]
```

Constructs a memory arena from the given memory arena.

Parameters

| | | |
|----|-------|--|
| in | arena | A reference to the memory arena to copy. |
|----|-------|--|

5.59.3.3 MemoryArena() [3/3]

```
mage::MemoryArena::MemoryArena (
    MemoryArena && arena ) [default]
```

Constructs a memory arena by moving the given memory arena.

Parameters

| | | |
|----|-------|--|
| in | arena | A reference to the memory arena to move. |
|----|-------|--|

5.59.3.4 ~MemoryArena()

```
mage::MemoryArena::~MemoryArena ( )
```

Destructs this memory arena.

5.59.4 Member Function Documentation

5.59.4.1 Alloc() [1/2]

```
void * mage::MemoryArena::Alloc ( size_t size )
```

Allocates a block of memory of the given size.

Parameters

| | | |
|----|-------------|--|
| in | <i>size</i> | The requested size in bytes to allocate in memory. |
|----|-------------|--|

Returns

`nullptr` if the allocation failed.
A pointer to the memory block that was allocated.

5.59.4.2 Alloc() [2/2]

```
template<typename DataT >
DataT* mage::MemoryArena::Alloc ( size_t count = 1,
                                  bool initialization = true )
```

Allocates a block of memory.

Template Parameters

| | |
|--------------|--|
| <i>DataT</i> | The type of objects to allocate in memory. |
|--------------|--|

Parameters

| | | |
|----|-----------------------|---|
| in | <i>count</i> | The number of objects of type <code>DataT</code> to allocate in memory. |
| in | <i>initialization</i> | Flag indicating whether the objects need to be initialized (i.e. the constructor needs to be called). |

Returns

`nullptr` if the allocation failed.
A pointer to the memory block that was allocated.

Note

The objects will be constructed with their default empty constructor.

5.59.4.3 GetBlockSize()

```
size_t mage::MemoryArena::GetBlockSize ( ) const
```

Returns the maximum block size of this memory arena.

Returns

The maximum block size of this memory arena.

5.59.4.4 GetCurrentBlockPtr()

```
char* mage::MemoryArena::GetCurrentBlockPtr ( ) const
```

Returns a pointer to the current block of this memory arena.

Returns

A pointer to the current block of this memory arena.

5.59.4.5 GetCurrentBlockSize()

```
size_t mage::MemoryArena::GetCurrentBlockSize ( ) const
```

Returns the block size (in bytes) of the current block of this memory arena.

Returns

The block size (in bytes) of the current block of this memory arena.

5.59.4.6 GetTotalBlockSize()

```
size_t mage::MemoryArena::GetTotalBlockSize ( ) const
```

Returns the block size (in bytes) of all blocks of this memory arena.

Returns

The block size (in bytes) of all blocks of this memory arena.

5.59.4.7 operator=() [1/2]

```
MemoryArena& mage::MemoryArena::operator= (
    const MemoryArena & arena ) [delete]
```

Copies the given memory arena to this memory arena.

Parameters

| | | |
|----|-------|--|
| in | arena | A reference to the memory arena to copy. |
|----|-------|--|

Returns

A reference to the copy of the given memory arena (i.e. this memory arena).

5.59.4.8 operator=() [2/2]

```
MemoryArena& mage::MemoryArena::operator= (
    MemoryArena && arena ) [delete]
```

Moves the given memory arena to this memory arena.

Parameters

| | | |
|----|-------|--|
| in | arena | A reference to the memory arena to move. |
|----|-------|--|

Returns

A reference to the moved memory arena (i.e. this memory arena).

5.59.4.9 Reset()

```
void mage::MemoryArena::Reset ( )
```

Resets this memory arena.

5.59.5 Member Data Documentation**5.59.5.1 m_available_blocks**

```
list< MemoryBlock > mage::MemoryArena::m_available_blocks [private]
```

A collection containing the available blocks of this memory arena.

5.59.5.2 m_block_size

```
const size_t mage::MemoryArena::m_block_size [private]
```

The fixed block size of this memory arena.

5.59.5.3 m_current_block

```
MemoryBlock mage::MemoryArena::m_current_block [private]
```

A pointer to the current block of this memory arena.

5.59.5.4 m_current_block_pos

```
size_t mage::MemoryArena::m_current_block_pos [private]
```

The current block position of this memory arena.

5.59.5.5 m_used_blocks

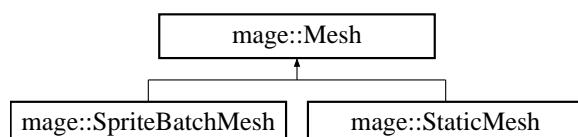
```
list< MemoryBlock > mage::MemoryArena::m_used_blocks [private]
```

A collection containing the used blocks of this memory arena.

5.60 mage::Mesh Class Reference

```
#include <mesh.hpp>
```

Inheritance diagram for mage::Mesh:



Public Member Functions

- virtual ~Mesh ()
- Mesh & operator= (const Mesh &mesh)=delete
- Mesh & operator= (Mesh &&mesh)=delete
- size_t GetVertexSize () const
- size_t GetNumberOfVertices () const
- size_t GetNumberOfIndices () const
- DXGI_FORMAT GetIndexFormat () const
- D3D11_PRIMITIVE_TOPOLOGY GetPrimitiveTopology () const
- void PrepareDrawing () const
- void Draw () const
- void Draw (size_t start_index, size_t nb_indices) const

Protected Member Functions

- [Mesh](#) (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, size_t vertex_size, DXGI_FORMAT index_format=DXGI_FORMAT_R32_UINT, D3D11_PRIMITIVE_TOPOLOGY primitive_topology=D3D11_PRIMITIVE_TOPOLOGY_TRIANGLELIST)
- [Mesh](#) (const [Mesh](#) &mesh)=delete
- [Mesh](#) ([Mesh](#) &&mesh)
- void [SetNumberOfVertices](#) (size_t nb_vertices)
- void [SetNumberOfIndices](#) (size_t nb_indices)

Protected Attributes

- ID3D11Device2 *const [m_device](#)
- ID3D11DeviceContext2 *const [m_device_context](#)
- ComPtr< ID3D11Buffer > [m_vertex_buffer](#)
- ComPtr< ID3D11Buffer > [m_index_buffer](#)

Private Attributes

- const size_t [m_vertex_size](#)
- size_t [m_nb_vertices](#)
- size_t [m_nb_indices](#)
- const DXGI_FORMAT [m_index_format](#)
- const D3D11_PRIMITIVE_TOPOLOGY [m_primitive_topology](#)

5.60.1 Detailed Description

A class of indexed meshes.

5.60.2 Constructor & Destructor Documentation

5.60.2.1 ~Mesh()

```
mage::Mesh::~Mesh ( ) [virtual], [default]
```

Destructs this mesh.

5.60.2.2 Mesh() [1/3]

```
mage::Mesh::Mesh (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    size_t vertex_size,
    DXGI_FORMAT index_format = DXGI_FORMAT_R32_UINT,
    D3D11_PRIMITIVE_TOPOLOGY primitive_topology = D3D11_PRIMITIVE_TOPOLOGY_TRIANGLELIST
) [explicit], [protected]
```

Constructs a mesh.

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|----|---------------------------|----------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>vertex_size</i> | The vertex size. |
| in | <i>index_format</i> | The index format. |
| in | <i>primitive_topology</i> | The primitive topology. |

5.60.2.3 Mesh() [2/3]

```
mage::Mesh::Mesh (
    const Mesh & mesh ) [protected], [delete]
```

Constructs a mesh from the given mesh.

Parameters

| | | |
|----|-------------|----------------------------------|
| in | <i>mesh</i> | A reference to the mesh to copy. |
|----|-------------|----------------------------------|

5.60.2.4 Mesh() [3/3]

```
mage::Mesh::Mesh (
    Mesh && mesh ) [protected], [default]
```

Constructs a mesh by moving the given mesh.

Parameters

| | | |
|----|-------------|----------------------------------|
| in | <i>mesh</i> | A reference to the mesh to move. |
|----|-------------|----------------------------------|

5.60.3 Member Function Documentation**5.60.3.1 Draw()** [1/2]

```
void mage::Mesh::Draw ( ) const
```

Draws this complete mesh.

5.60.3.2 Draw() [2/2]

```
void mage::Mesh::Draw (
    size_t start_index,
    size_t nb_indices ) const
```

Draws a submesh of this mesh.

Parameters

| | | |
|----|--------------------|------------------------|
| in | <i>start_index</i> | The start index. |
| in | <i>nb_indices</i> | The number of indices. |

5.60.3.3 GetIndexFormat()

```
DXGI_FORMAT mage::Mesh::GetIndexFormat ( ) const
```

Returns the index format of this mesh.

Returns

The index format of this mesh.

5.60.3.4 GetNumberOfIndices()

```
size_t mage::Mesh::GetNumberOfIndices ( ) const
```

Returns the number of indices of this mesh.

Returns

The number of indices of this mesh.

5.60.3.5 GetNumberOfVertices()

```
size_t mage::Mesh::GetNumberOfVertices ( ) const
```

Returns the number of vertices of this mesh.

Returns

The number of vertices of this mesh.

5.60.3.6 GetPrimitiveTopology()

```
D3D11_PRIMITIVE_TOPOLOGY mage::Mesh::GetPrimitiveTopology ( ) const
```

Returns the primitive topology of this mesh.

Returns

The primitive topology of this mesh.

5.60.3.7 GetVertexSize()

```
size_t mage::Mesh::GetVertexSize ( ) const
```

Returns the size (in bytes) of the vertices of this mesh.

Returns

The vertex size (in bytes) of this static mesh.

5.60.3.8 operator=() [1/2]

```
Mesh& mage::Mesh::operator= (
    const Mesh & mesh ) [delete]
```

Copies the given mesh to this mesh.

Parameters

| | | |
|----|-------------|----------------------------------|
| in | <i>mesh</i> | A reference to the mesh to copy. |
|----|-------------|----------------------------------|

Returns

A reference to the copy of the given mesh (i.e. this mesh).

5.60.3.9 operator=() [2/2]

```
Mesh& mage::Mesh::operator= (
    Mesh && mesh ) [delete]
```

Moves the given mesh to this mesh.

Parameters

| | | |
|----|-------------|----------------------------------|
| in | <i>mesh</i> | A reference to the mesh to move. |
|----|-------------|----------------------------------|

Returns

A reference to the moved mesh (i.e. this mesh).

5.60.3.10 PrepareDrawing()

```
void mage::Mesh::PrepareDrawing ( ) const
```

Prepares the drawing of this mesh.

The vertex buffer, index buffer and primitive topology of this mesh will be bound to the input-assembler stage.

5.60.3.11 SetNumberOfIndices()

```
void mage::Mesh::SetNumberOfIndices (
    size_t nb_indices ) [protected]
```

Sets the number of indices of this mesh to the given number.

Parameters

| | | |
|----|-------------------|-------------------------------------|
| in | <i>nb_indices</i> | The number of indices of this mesh. |
|----|-------------------|-------------------------------------|

5.60.3.12 SetNumberOfVertices()

```
void mage::Mesh::SetNumberOfVertices (
    size_t nb_vertices ) [protected]
```

Sets the number of vertices of this mesh to the given number.

Parameters

| | | |
|----|--------------------|--------------------------------------|
| in | <i>nb_vertices</i> | The number of vertices of this mesh. |
|----|--------------------|--------------------------------------|

5.60.4 Member Data Documentation

5.60.4.1 m_device

```
ID3D11Device2* const mage::Mesh::m_device [protected]
```

A pointer to the device of this mesh.

5.60.4.2 m_device_context

```
ID3D11DeviceContext2* const mage::Mesh::m_device_context [protected]
```

A pointer to the device context of this mesh.

5.60.4.3 m_index_buffer

```
ComPtr< ID3D11Buffer > mage::Mesh::m_index_buffer [protected]
```

A pointer to the index buffer of this mesh.

5.60.4.4 m_index_format

```
const DXGI_FORMAT mage::Mesh::m_index_format [private]
```

The index format of this mesh.

5.60.4.5 m_nb_indices

```
size_t mage::Mesh::m_nb_indices [private]
```

The number of indices of this mesh.

5.60.4.6 m_nb_vertices

```
size_t mage::Mesh::m_nb_vertices [private]
```

The number of vertices of this mesh.

5.60.4.7 m_primitive_topology

```
const D3D11_PRIMITIVE_TOPOLOGY mage::Mesh::m_primitive_topology [private]
```

The primitive topology of this mesh.

5.60.4.8 m_vertex_buffer

```
ComPtr< ID3D11Buffer > mage::Mesh::m_vertex_buffer [protected]
```

A pointer to the vertex buffer of this mesh.

5.60.4.9 m_vertex_size

```
const size_t mage::Mesh::m_vertex_size [private]
```

The vertex size of this static mesh.

5.61 mage::MeshDescriptor< VertexT > Struct Template Reference

```
#include <mesh_descriptor.hpp>
```

Public Member Functions

- [MeshDescriptor \(bool invert_handedness=false, bool clockwise_order=true\)](#)
- [MeshDescriptor \(const MeshDescriptor< VertexT > &desc\)=default](#)
- [MeshDescriptor \(MeshDescriptor< VertexT > &&desc\)=default](#)
- [~MeshDescriptor \(\)=default](#)
- [MeshDescriptor & operator= \(const MeshDescriptor< VertexT > &desc\)=default](#)
- [MeshDescriptor & operator= \(MeshDescriptor< VertexT > &&desc\)=default](#)
- [bool InvertHandness \(\) const](#)
- [bool ClockwiseOrder \(\) const](#)

Private Attributes

- [bool m_invert_handedness](#)
- [bool m_clockwise_order](#)

5.61.1 Detailed Description

```
template<typename VertexT>
struct mage::MeshDescriptor< VertexT >
```

A struct of mesh descriptors.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | the vertex type. |
|----------------|------------------|

5.61.2 Constructor & Destructor Documentation**5.61.2.1 MeshDescriptor() [1/3]**

```
template<typename VertexT>
mage::MeshDescriptor< VertexT >::MeshDescriptor (
    bool invert_handedness = false,
    bool clockwise_order = true ) [explicit]
```

Constructs a mesh descriptor.

Parameters

| | | |
|----|--------------------------|--|
| in | <i>invert_handedness</i> | A flag indicating whether the mesh coordinate system handedness should be inverted. |
| in | <i>clockwise_order</i> | A flag indicating whether the face vertices should be defined in clockwise order or not (i.e. counterclockwise order). |

5.61.2.2 MeshDescriptor() [2/3]

```
template<typename VertexT>
mage::MeshDescriptor< VertexT >::MeshDescriptor (
    const MeshDescriptor< VertexT > & desc ) [default]
```

Constructs a mesh descriptor from the given mesh descriptor.

Parameters

| | | |
|----|-------------|---|
| in | <i>desc</i> | A reference to the mesh descriptor to copy. |
|----|-------------|---|

5.61.2.3 MeshDescriptor() [3/3]

```
template<typename VertexT>
mage::MeshDescriptor< VertexT >::MeshDescriptor (
    MeshDescriptor< VertexT > && desc ) [default]
```

Constructs a mesh descriptor by moving the given mesh descriptor.

Parameters

| | | |
|----|-------------|---|
| in | <i>desc</i> | A reference to the mesh descriptor to move. |
|----|-------------|---|

5.61.2.4 ~MeshDescriptor()

```
template<typename VertexT>
mage::MeshDescriptor< VertexT >::~MeshDescriptor( ) [default]
```

Destructs this mesh descriptor.

5.61.3 Member Function Documentation

5.61.3.1 ClockwiseOrder()

```
template<typename VertexT>
bool mage::MeshDescriptor< VertexT >::ClockwiseOrder( ) const
```

Checks whether the face vertices should be defined in clockwise order or not (i.e. counterclockwise order) according to this mesh descriptor.

Returns

`true` if the face vertices should be defined in clockwise order. `false` otherwise.

5.61.3.2 InvertHandness()

```
template<typename VertexT>
bool mage::MeshDescriptor< VertexT >::InvertHandness( ) const
```

Checks whether the mesh coordinate system handness should be inverted or not according to this mesh descriptor.

Returns

`true` if the mesh coordinate system handness should be inverted. `false` otherwise.

5.61.3.3 operator=() [1/2]

```
template<typename VertexT>
MeshDescriptor& mage::MeshDescriptor< VertexT >::operator= (
    const MeshDescriptor< VertexT > & desc ) [default]
```

Copies the given mesh descriptor to this mesh descriptor.

Parameters

| | | |
|----|-------------------|---|
| in | <code>desc</code> | A reference to the mesh descriptor to copy. |
|----|-------------------|---|

Returns

A reference to the copy of the given mesh descriptor (i.e. this mesh descriptor).

5.61.3.4 operator=() [2/2]

```
template<typename VertexT>
MeshDescriptor& mage::MeshDescriptor< VertexT >::operator= (
    MeshDescriptor< VertexT > && desc ) [default]
```

Moves the given mesh descriptor to this mesh descriptor.

Parameters

| | | |
|----|-------------|---|
| in | <i>desc</i> | A reference to the mesh descriptor to move. |
|----|-------------|---|

Returns

A reference to the moved mesh descriptor (i.e. this mesh descriptor).

5.61.4 Member Data Documentation

5.61.4.1 m_clockwise_order

```
template<typename VertexT>
bool mage::MeshDescriptor< VertexT >::m_clockwise_order [private]
```

A flag indicating whether the face vertices should be defined in clockwise order or not (i.e. counterclockwise order) for this mesh descriptor.

5.61.4.2 m_invert_handedness

```
template<typename VertexT>
bool mage::MeshDescriptor< VertexT >::m_invert_handedness [private]
```

A flag indicating whether the mesh coordinate system handedness should be inverted or not for this mesh descriptor.

5.62 mage::Model Class Reference

```
#include <model.hpp>
```

Public Member Functions

- [Model \(SharedPtr< const Mesh > mesh, size_t start_index, size_t nb_indices, const ShadedMaterial &material\)](#)
- [Model \(const Model &model\)](#)
- [Model \(Model &&model\)](#)
- [virtual ~Model \(\)](#)
- [Model & operator= \(const Model &model\)=delete](#)
- [Model & operator= \(Model &&model\)=delete](#)
- [UniquePtr< Model > Clone \(\) const](#)
- [size_t GetStartIndex \(\) const](#)

- `size_t GetNumberOflndices () const`
- `const Mesh * GetMesh () const`
- `void PrepareDrawing () const`
- `void Draw () const`
- `Material & GetMaterial ()`
- `const Material & GetMaterial () const`
- `ShadedMaterial * GetShadedMaterial ()`
- `const ShadedMaterial * GetShadedMaterial () const`
- `void PrepareShading (ID3D11Buffer *transform, const Lighting &lighting) const`

Private Member Functions

- `virtual UniquePtr< Model > CloneImplementation () const`

Private Attributes

- `SharedPtr< const Mesh > m_mesh`
- `const size_t m_start_index`
- `const size_t m_nb_indices`
- `UniquePtr< ShadedMaterial > m_material`

5.62.1 Detailed Description

A class of models.

5.62.2 Constructor & Destructor Documentation

5.62.2.1 Model() [1/3]

```
mage::Model::Model (
    SharedPtr< const Mesh > mesh,
    size_t start_index,
    size_t nb_indices,
    const ShadedMaterial & material ) [explicit]
```

Constructs a model.

Parameters

| | | |
|-----------------|--------------------------|-------------------------------------|
| <code>in</code> | <code>mesh</code> | A pointer to the mesh. |
| <code>in</code> | <code>start_index</code> | The start index in the mesh. |
| <code>in</code> | <code>nb_indices</code> | The number of indices in the mesh. |
| <code>in</code> | <code>material</code> | A reference to the shaded material. |

5.62.2.2 Model() [2/3]

```
mage::Model::Model (
```

```
const Model & model )
```

Constructs a model from the given model.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | model | A reference to the model to copy. |
|----|-------|-----------------------------------|

5.62.2.3 Model() [3/3]

```
mage::Model::Model (
```

```
Model && model ) [default]
```

Constructs a model by moving the given model.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | model | A reference to the model to move. |
|----|-------|-----------------------------------|

5.62.2.4 ~Model()

```
mage::Model::~Model ( ) [virtual], [default]
```

Destructs this model.

5.62.3 Member Function Documentation

5.62.3.1 Clone()

```
UniquePtr< Model > mage::Model::Clone ( ) const
```

Clones this model.

Returns

A pointer to the clone of this model.

5.62.3.2 ClonImplementation()

```
UniquePtr< Model > mage::Model::CloneImplementation ( ) const [private], [virtual]
```

Clones this model.

Returns

A pointer to the clone of this model.

5.62.3.3 Draw()

```
void mage::Model::Draw ( ) const
```

Draws this model.

5.62.3.4 GetMaterial() [1/2]

```
Material& mage::Model::GetMaterial ( )
```

Returns the material of this model.

Returns

A reference to the material of this model.

5.62.3.5 GetMaterial() [2/2]

```
const Material& mage::Model::GetMaterial ( ) const
```

Returns the material of this model.

Returns

A reference to the material of this model.

5.62.3.6 GetMesh()

```
const Mesh* mage::Model::GetMesh ( ) const
```

Returns the mesh of this model.

Returns

A pointer to the mesh of this model.

5.62.3.7 GetNumberOfIndices()

```
size_t mage::Model::GetNumberOfIndices ( ) const
```

Returns the number of indices of this model in the mesh of this model.

Returns

The number of indices of this model in the mesh of this model.

5.62.3.8 GetShadedMaterial() [1/2]

```
ShadedMaterial* mage::Model::GetShadedMaterial ( )
```

Returns the shaded material of this model.

Returns

A reference to the shaded material of this model.

5.62.3.9 GetShadedMaterial() [2/2]

```
const ShadedMaterial* mage::Model::GetShadedMaterial ( ) const
```

Returns the shaded material of this model.

Returns

A reference to the shaded material of this model.

5.62.3.10 GetstartIndex()

```
size_t mage::Model::GetstartIndex ( ) const
```

Returns the start index of this model in the mesh of this model.

Returns

The start index of this model in the mesh of this model.

5.62.3.11 operator=() [1/2]

```
Model& mage::Model::operator= (
    const Model & model ) [delete]
```

Copies the given model to this model.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | model | A reference to the model to copy. |
|----|-------|-----------------------------------|

Returns

A reference to the copy of the given model (i.e. this model).

5.62.3.12 operator=() [2/2]

```
Model& mage::Model::operator= (
    Model && model ) [delete]
```

Moves the given model to this model.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>model</i> | A reference to the model to move. |
|----|--------------|-----------------------------------|

Returns

A reference to the moved model (i.e. this model).

5.62.3.13 PrepareDrawing()

```
void mage::Model::PrepareDrawing ( ) const
```

Prepares this model for drawing.

5.62.3.14 PrepareShading()

```
void mage::Model::PrepareShading (
    ID3D11Buffer * transform,
    const Lighting & lighting ) const
```

Prepares this model for shading.

Precondition

transform is not equal to `nullptr`.

Parameters

| | | |
|----|------------------|-------------------------------------|
| in | <i>transform</i> | A pointer to the transform buffer. |
| in | <i>lighting</i> | A reference to the lighting buffer. |

5.62.4 Member Data Documentation

5.62.4.1 m_material

```
UniquePtr< ShadedMaterial > mage::Model::m_material [private]
```

A pointer to the shaded material of this model.

5.62.4.2 m_mesh

```
SharedPtr< const Mesh > mage::Model::m_mesh [private]
```

A pointer to the mesh of this model.

5.62.4.3 m_nb_indices

```
const size_t mage::Model::m_nb_indices [private]
```

The number of indices of this model in the mesh of this model.

5.62.4.4 m_start_index

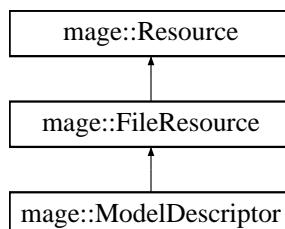
```
const size_t mage::Model::m_start_index [private]
```

The start index of this model in the mesh of this model.

5.63 mage::ModelDescriptor Class Reference

```
#include <model_descriptor.hpp>
```

Inheritance diagram for mage::ModelDescriptor:



Public Member Functions

- template<typename VertexT >
 ModelDescriptor (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const wstring &fname, const MeshDescriptor< VertexT > &desc=**MeshDescriptor**< VertexT >())
- **ModelDescriptor** (const **ModelDescriptor** &desc)=delete
- **ModelDescriptor** (**ModelDescriptor** &&desc)
- virtual ~**ModelDescriptor** ()
- **ModelDescriptor** & **operator=** (const **ModelDescriptor** &desc)=delete
- **ModelDescriptor** & **operator=** (**ModelDescriptor** &&desc)=delete
- **SharedPtr< const StaticMesh > GetMesh () const**
- const **Material** * **GetMaterial** (const string &name) const
- template<typename ActionT >
 void **ForEachMaterial** (ActionT action) const
- const **ModelPart** * **GetModelPart** (const string &name) const
- template<typename ActionT >
 void **ForEachModelPart** (ActionT action) const

Private Attributes

- `SharedPtr< StaticMesh > m_mesh`
- `vector< Material > m_materials`
- `vector< ModelPart > m_model_parts`

5.63.1 Detailed Description

A class of model descriptors describing a complete model.

5.63.2 Constructor & Destructor Documentation

5.63.2.1 ModelDescriptor() [1/3]

```
template<typename VertexT >
mage::ModelDescriptor::ModelDescriptor (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const wstring & fname,
    const MeshDescriptor< VertexT > & desc = MeshDescriptor< VertexT >() ) [explicit]
```

Constructs a model descriptor.

Precondition

`device` is not equal to `nullptr`.
`device_context` is not equal to `nullptr`.

Template Parameters

| | |
|----------------------|------------------|
| <code>VertexT</code> | The vertex type. |
|----------------------|------------------|

Parameters

| | | |
|----|-----------------------------|-------------------------------------|
| in | <code>device</code> | A pointer to the device. |
| in | <code>device_context</code> | A pointer to the device context. |
| in | <code>fname</code> | A reference to the filename. |
| in | <code>desc</code> | A reference to the mesh descriptor. |

Exceptions

| | |
|---------------------------------|--|
| <code>FormattedException</code> | Failed to initialize the model descriptor. |
|---------------------------------|--|

5.63.2.2 ModelDescriptor() [2/3]

```
mage::ModelDescriptor::ModelDescriptor (
    const ModelDescriptor & desc ) [delete]
```

Constructs a model descriptor from the given model descriptor.

Parameters

| | | |
|----|-------------|--|
| in | <i>desc</i> | A reference to the model descriptor to copy. |
|----|-------------|--|

5.63.2.3 ModelDescriptor() [3/3]

```
mage::ModelDescriptor::ModelDescriptor (
    ModelDescriptor && desc ) [default]
```

Constructs a model descriptor by moving the given model descriptor.

Parameters

| | | |
|----|-------------|--|
| in | <i>desc</i> | A reference to the model descriptor to move. |
|----|-------------|--|

5.63.2.4 ~ModelDescriptor()

```
mage::ModelDescriptor::~ModelDescriptor ( ) [virtual]
```

Destructs a model descriptor.

5.63.3 Member Function Documentation

5.63.3.1 ForEachMaterial()

```
template<typename ActionT >
void mage::ModelDescriptor::ForEachMaterial (
    ActionT action ) const
```

Traverses all materials of this model descriptor.

Template Parameters

| | |
|---------|--|
| ActionT | An action to perform on all materials of this model descriptor. The action must accept const Material& values. |
|---------|--|

5.63.3.2 ForEachModelPart()

```
template<typename ActionT >
void mage::ModelDescriptor::ForEachModelPart (
    ActionT action ) const
```

Traverses all model parts of this model descriptor.

Template Parameters

| | |
|-----------------|--|
| Action <i>T</i> | An action to perform on all model parts of this model descriptor. The action must accept <code>const ModelPart&</code> values. |
|-----------------|--|

5.63.3.3 GetMaterial()

```
const Material * mage::ModelDescriptor::GetMaterial ( const string & name ) const
```

Returns the material corresponding to the given name.

Parameters

| | | |
|----|-------------|--|
| in | <i>name</i> | A reference to the name of the material. |
|----|-------------|--|

Returns

`nullptr` if this model descriptor contains no material matching the given name *name*.
A pointer to the material of this model descriptor matching the given name *name*.

5.63.3.4 GetMesh()

```
SharedPtr< const StaticMesh > mage::ModelDescriptor::GetMesh ( ) const
```

Returns the mesh of this model descriptor.

Returns

A pointer to the mesh of this model descriptor.

5.63.3.5 GetModelPart()

```
const ModelPart * mage::ModelDescriptor::GetModelPart ( const string & name ) const
```

Returns the model part corresponding to the given name.

Parameters

| | | |
|----|-------------|--|
| in | <i>name</i> | A reference to the name of the model part. |
|----|-------------|--|

Returns

`nullptr` if this model descriptor contains no model part matching the given name *name*.
A pointer to the model part of this model descriptor matching the given name *name*.

5.63.3.6 operator=() [1/2]

```
ModelDescriptor& mage::ModelDescriptor::operator= (
    const ModelDescriptor & desc ) [delete]
```

Copies the given model descriptor to this model descriptor.

Parameters

| | | |
|----|-------------|--|
| in | <i>desc</i> | A reference to the model descriptor to copy. |
|----|-------------|--|

5.63.3.7 operator=() [2/2]

```
ModelDescriptor& mage::ModelDescriptor::operator= (
    ModelDescriptor && desc ) [delete]
```

Moves the given model descriptor to this model descriptor.

Parameters

| | | |
|----|-------------|--|
| in | <i>desc</i> | A reference to the model descriptor to move. |
|----|-------------|--|

5.63.4 Member Data Documentation

5.63.4.1 m_materials

```
vector< Material > mage::ModelDescriptor::m_materials [private]
```

A vector containing all the materials of the model of this model descriptor.

5.63.4.2 m_mesh

```
SharedPtr< StaticMesh > mage::ModelDescriptor::m_mesh [private]
```

A pointer to the mesh of the model of this model descriptor.

5.63.4.3 m_model_parts

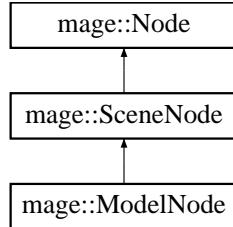
```
vector< ModelPart > mage::ModelDescriptor::m_model_parts [private]
```

A vector containing all the model parts of the model of this model descriptor.

5.64 mage::ModelNode Class Reference

```
#include <model_node.hpp>
```

Inheritance diagram for mage::ModelNode:



Public Member Functions

- `ModelNode (const string &name, UniquePtr< Model > &&model)`
- `ModelNode (const ModelNode &model_node)`
- `ModelNode (ModelNode &&model_node)`
- `virtual ~ModelNode ()`
- `ModelNode & operator= (const ModelNode &model_node)=delete`
- `ModelNode & operator= (ModelNode &&model_node)=delete`
- `UniquePtr< ModelNode > Clone () const`
- `Model * GetModel ()`
- `const Model * GetModel () const`

Private Member Functions

- `virtual UniquePtr< Node > CloneImplementation () const override`

Private Attributes

- `UniquePtr< Model > m_model`

5.64.1 Constructor & Destructor Documentation

5.64.1.1 ModelNode() [1/3]

```
mage::ModelNode::ModelNode (
    const string & name,
    UniquePtr< Model > && model ) [explicit]
```

5.64.1.2 ModelNode() [2/3]

```
mage::ModelNode::ModelNode (
    const ModelNode & model_node )
```

5.64.1.3 `ModelNode()` [3/3]

```
mage::ModelNode::ModelNode (
    ModelNode && model_node ) [default]
```

5.64.1.4 `~ModelNode()`

```
mage::ModelNode::~ModelNode () [virtual], [default]
```

5.64.2 Member Function Documentation

5.64.2.1 `Clone()`

```
UniquePtr< ModelNode > mage::ModelNode::Clone () const
```

5.64.2.2 `CloneImplementation()`

```
UniquePtr< Node > mage::ModelNode::CloneImplementation () const [override], [private], [virtual]
```

Clones this node.

Returns

A pointer to the clone of this node.

Reimplemented from [mage::SceneNode](#).

5.64.2.3 `GetModel()` [1/2]

```
Model* mage::ModelNode::GetModel ()
```

5.64.2.4 `GetModel()` [2/2]

```
const Model* mage::ModelNode::GetModel () const
```

5.64.2.5 `operator=()` [1/2]

```
ModelNode& mage::ModelNode::operator= (
    const ModelNode & model_node ) [delete]
```

5.64.2.6 `operator=()` [2/2]

```
ModelNode& mage::ModelNode::operator= (
    ModelNode && model_node ) [delete]
```

5.64.3 Member Data Documentation

5.64.3.1 m_model

```
UniquePtr< Model > mage::ModelNode::m_model [private]
```

5.65 mage::ModelOutput< VertexT > Struct Template Reference

```
#include <model_output.hpp>
```

Public Member Functions

- [ModelOutput \(\)=default](#)
- [ModelOutput \(const ModelOutput< VertexT > &output\)=delete](#)
- [ModelOutput \(ModelOutput< VertexT > &&output\)=default](#)
- [~ModelOutput \(\)=default](#)
- [ModelOutput< VertexT > & operator= \(const ModelOutput< VertexT > &output\)=delete](#)
- [ModelOutput< VertexT > & operator= \(ModelOutput< VertexT > &&output\)=delete](#)
- [bool HasModelPart \(const string &name\)](#)
- [void StartModelPart \(const string &child, const string &parent=MAGE_MDL_PART_DEFAULT_PARENT\)](#)
- [void SetMaterial \(const string &material\)](#)
- [void EndModelPart \(\)](#)

Public Attributes

- [vector< VertexT > m_vertex_buffer](#)
- [vector< uint32_t > m_index_buffer](#)
- [vector< Material > m_material_buffer](#)
- [vector< ModelPart > m_model_parts](#)

5.65.1 Detailed Description

```
template<typename VertexT>
struct mage::ModelOutput< VertexT >
```

A struct of model outputs.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

5.65.2 Constructor & Destructor Documentation

5.65.2.1 ModelOutput() [1/3]

```
template<typename VertexT>
mage::ModelOutput< VertexT >::ModelOutput ( ) [default]
```

Constructs a model output.

5.65.2.2 ModelOutput() [2/3]

```
template<typename VertexT>
mage::ModelOutput< VertexT >::ModelOutput (
    const ModelOutput< VertexT > & output ) [delete]
```

Constructs a model output from the given model output.

Parameters

| | | |
|----|---------------|--|
| in | <i>output</i> | A reference to the model output to copy. |
|----|---------------|--|

5.65.2.3 ModelOutput() [3/3]

```
template<typename VertexT>
mage::ModelOutput< VertexT >::ModelOutput (
    ModelOutput< VertexT > && output ) [default]
```

Constructs a model output by moving the given model output.

Parameters

| | | |
|----|---------------|--|
| in | <i>output</i> | A reference to the model output to move. |
|----|---------------|--|

5.65.2.4 ~ModelOutput()

```
template<typename VertexT>
mage::ModelOutput< VertexT >::~ModelOutput ( ) [default]
```

Destructs this model output.

5.65.3 Member Function Documentation

5.65.3.1 EndModelPart()

```
template<typename VertexT>
void mage::ModelOutput< VertexT >::EndModelPart ( )
```

Ends the creation of the last model part.

Precondition

This model output contains at least one model part.

5.65.3.2 HasModelPart()

```
template<typename VertexT>
bool mage::ModelOutput< VertexT >::HasModelPart (
    const string & name )
```

Checks whether this model output contains a model part with the given name.

Parameters

| | | |
|----|-------------|-----------------------------|
| in | <i>name</i> | The name of the model part. |
|----|-------------|-----------------------------|

5.65.3.3 operator=() [1/2]

```
template<typename VertexT>
ModelOutput< VertexT >& mage::ModelOutput< VertexT >::operator= (
    const ModelOutput< VertexT > & output ) [delete]
```

Copies the given model output to this model output.

Parameters

| | | |
|----|---------------|--|
| in | <i>output</i> | A reference to the model output to copy. |
|----|---------------|--|

Returns

A reference to the copy of the given model output (i.e. this model output).

5.65.3.4 operator=() [2/2]

```
template<typename VertexT>
ModelOutput< VertexT >& mage::ModelOutput< VertexT >::operator= (
    ModelOutput< VertexT > && output ) [delete]
```

Moves the given model output to this model output.

Parameters

| | | |
|----|---------------|--|
| in | <i>output</i> | A reference to the model output to move. |
|----|---------------|--|

Returns

A reference to the moved model output (i.e. this model output).

5.65.3.5 SetMaterial()

```
template<typename VertexT>
void mage::ModelOutput< VertexT >::SetMaterial (
    const string & material )
```

Sets the name of the material of the last model part to the given material name.

Precondition

This model output contains at least one model part.

Parameters

| | | |
|----|-----------------|--|
| in | <i>material</i> | A reference to the name of the material. |
|----|-----------------|--|

5.65.3.6 StartModelPart()

```
template<typename VertexT>
void mage::ModelOutput< VertexT >::StartModelPart (
    const string & child,
    const string & parent = MAGE_MDL_PART_DEFAULT_PARENT )
```

Starts the creation of a new model part.

Parameters

| | | |
|----|---------------|---|
| in | <i>child</i> | A reference to the name. |
| in | <i>parent</i> | A reference to the name of the parent model part. |

5.65.4 Member Data Documentation

5.65.4.1 m_index_buffer

```
template<typename VertexT>
vector< uint32_t > mage::ModelOutput< VertexT >::m_index_buffer
```

A vector containing the indices of this model output.

5.65.4.2 m_material_buffer

```
template<typename VertexT>
vector< Material > mage::ModelOutput< VertexT >::m_material_buffer
```

A vector containing the materials of this model output.

5.65.4.3 m_model_parts

```
template<typename VertexT>
vector< ModelPart > mage::ModelOutput< VertexT >::m_model_parts
```

A vector containing the model parts of this model output.

5.65.4.4 m_vertex_buffer

```
template<typename VertexT>
vector< VertexT > mage::ModelOutput< VertexT >::m_vertex_buffer
```

A vector containing the vertices of this model output.

5.66 mage::ModelPart Struct Reference

```
#include <model_output.hpp>
```

Public Member Functions

- [ModelPart](#) (const string &child=MAGE_MDL_PART_DEFAULT_CHILD, const string &parent=MAGE_MDL_PART_DEFAULT_PARENT, uint32_t start_index=0, uint32_t nb_indices=0, const string &material=MAGE_MDL_PART_DEFAULT_MATERIAL)
- [ModelPart](#) (const ModelPart &model_part)=default
- [ModelPart \(ModelPart &&model_part\)](#)=default
- [~ModelPart \(\)](#)=default
- [ModelPart & operator= \(const ModelPart &model_part\)](#)=default
- [ModelPart & operator= \(ModelPart &&model_part\)](#)=default

Public Attributes

- string [m_child](#)
- string [m_parent](#)
- string [m_material](#)
- uint32_t [m_start_index](#)
- uint32_t [m_nb_indices](#)

5.66.1 Detailed Description

A struct of model parts.

5.66.2 Constructor & Destructor Documentation

5.66.2.1 [ModelPart\(\)](#) [1/3]

```
mage::ModelPart::ModelPart (
    const string & child = MAGE_MDL_PART_DEFAULT_CHILD,
    const string & parent = MAGE_MDL_PART_DEFAULT_PARENT,
    uint32_t start_index = 0,
    uint32_t nb_indices = 0,
    const string & material = MAGE_MDL_PART_DEFAULT_MATERIAL ) [explicit]
```

Constructs a model part.

Parameters

| | | |
|----|--------------------|---|
| in | <i>child</i> | A reference to the name. |
| in | <i>parent</i> | A reference to the name of the parent. |
| in | <i>start_index</i> | The start index. |
| in | <i>nb_indices</i> | The number of indices. A reference to the name of the material. |
| in | <i>material</i> | A reference to the material name. |

5.66.2.2 ModelPart() [2/3]

```
mage::ModelPart::ModelPart (
    const ModelPart & model_part ) [default]
```

Constructs a model part from the given model part.

Parameters

| | | |
|----|-------------------|--|
| in | <i>model_part</i> | A reference to the model part to copy. |
|----|-------------------|--|

5.66.2.3 ModelPart() [3/3]

```
mage::ModelPart::ModelPart (
    ModelPart && model_part ) [default]
```

Constructs a model part by moving the given model part.

Parameters

| | | |
|----|-------------------|--|
| in | <i>model_part</i> | A reference to the model part to move. |
|----|-------------------|--|

5.66.2.4 ~ModelPart()

```
mage::ModelPart::~ModelPart ( ) [default]
```

Destructs this model part.

5.66.3 Member Function Documentation**5.66.3.1 operator=() [1/2]**

```
ModelPart& mage::ModelPart::operator= (
    const ModelPart & model_part ) [default]
```

Copies the given model part to this model part.

Parameters

| | | |
|----|-------------------|--|
| in | <i>model_part</i> | A reference to the model part to copy. |
|----|-------------------|--|

Returns

A reference to the copy of the given model part (i.e. this model part).

5.66.3.2 operator=() [2/2]

```
ModelPart& mage::ModelPart::operator= (
    ModelPart && model_part ) [default]
```

Moves the given model part to this model part.

Parameters

| | | |
|----|-------------------|--|
| in | <i>model_part</i> | A reference to the model part to move. |
|----|-------------------|--|

Returns

A reference to the moved model part (i.e. this model part).

5.66.4 Member Data Documentation**5.66.4.1 m_child**

```
string mage::ModelPart::m_child
```

The name of this model part.

5.66.4.2 m_material

```
string mage::ModelPart::m_material
```

The name of the material of this model part.

5.66.4.3 m_nb_indices

```
uint32_t mage::ModelPart::m_nb_indices
```

The number of indices of this model part in the mesh of the corresponding model.

5.66.4.4 m_parent

```
string mage::ModelPart::m_parent
```

The name of the parent model part of this model part.

5.66.4.5 m_start_index

```
uint32_t mage::ModelPart::m_start_index
```

The start index of this model part in the mesh of the corresponding model.

5.67 mage::Mouse Class Reference

```
#include <mouse.hpp>
```

Public Member Functions

- `Mouse (HWND hwnd, IDirectInput8 *di)`
- `Mouse (const Mouse &mouse)=delete`
- `Mouse (Mouse &&mouse)`
- `~Mouse ()`
- `Mouse & operator= (const Mouse &mouse)=delete`
- `Mouse & operator= (Mouse &&mouse)=delete`
- `void Update ()`
- `bool GetMouseButtonPress (char mouse_button, bool ignore_press_stamp=false) const`
- `int32_t GetPositionX () const`
- `int32_t GetPositionY () const`
- `int32_t GetDeltaX () const`
- `int32_t GetDeltaY () const`
- `int32_t GetDeltaWheel () const`

Private Member Functions

- `void InitializeMouse ()`

Private Attributes

- `const HWND m(hwnd)`
- `IDirectInput8 *const m_di`
- `ComPtr<IDirectInputDevice8> m_mouse`
- `uint64_t m_press_stamp`
- `DIMOUSESTATE m_mouse_state`
- `uint64_t m_mouse_button_press_stamp [3]`
- `POINT m_mouse_position`

5.67.1 Detailed Description

A class of mouses.

5.67.2 Constructor & Destructor Documentation

5.67.2.1 Mouse() [1/3]

```
mage::Mouse::Mouse (
    HWND hwindow,
    IDirectInput8 * di ) [explicit]
```

Constructs a mouse.

Precondition

hwindow is not equal to `nullptr`.
di is not equal to `nullptr`.

Parameters

| | | |
|----|----------------|-------------------------------------|
| in | <i>hwindow</i> | The handle of the parent window. |
| in | <i>di</i> | A pointer to a direct input object. |

Exceptions

| | |
|---------------------------|---------------------------------|
| <i>FormattedException</i> | Failed to initialize the mouse. |
|---------------------------|---------------------------------|

5.67.2.2 Mouse() [2/3]

```
mage::Mouse::Mouse (
    const Mouse & mouse ) [delete]
```

Constructs a mouse from the given mouse.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>mouse</i> | A reference to the mouse to copy. |
|----|--------------|-----------------------------------|

5.67.2.3 Mouse() [3/3]

```
mage::Mouse::Mouse (
    Mouse && mouse ) [default]
```

Constructs a mouse by moving the given mouse.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>mouse</i> | A reference to the mouse to move. |
|----|--------------|-----------------------------------|

5.67.2.4 ~Mouse()

```
mage::Mouse::~Mouse ( ) [default]
```

Destructs this mouse.

5.67.3 Member Function Documentation

5.67.3.1 GetDeltaWheel()

```
int32_t mage::Mouse::GetDeltaWheel ( ) const
```

Returns the change in this mouse's scroll wheel.

Returns

The change in this mouse's scroll wheel.

5.67.3.2 GetDeltaX()

```
int32_t mage::Mouse::GetDeltaX ( ) const
```

Returns the change in this mouse's horizontal coordinate.

Returns

The change in this mouse's horizontal coordinate.

5.67.3.3 GetDeltaY()

```
int32_t mage::Mouse::GetDeltaY ( ) const
```

Returns the change in this mouse's vertical coordinate.

Returns

The change in this mouse's vertical coordinate.

5.67.3.4 GetMouseButtonPress()

```
bool mage::Mouse::GetMouseButtonPress (
    char mouse_button,
    bool ignore_press_stamp = false ) const
```

Checks whether the given mouse button of this mouse is pressed.

Parameters

| | | |
|----|---------------------------|--|
| in | <i>mouse_button</i> | The mouse button. |
| in | <i>ignore_press_stamp</i> | Flag indicating whether press stamps should be ignored. Consistent presses will return false when using the press stamp. |

Returns

true if the given mouse button is pressed. false otherwise.

5.67.3.5 GetPositionX()

```
int32_t mage::Mouse::GetPositionX ( ) const
```

Returns the horizontal position of this mouse.

Returns

The horizontal position of this mouse.

5.67.3.6 GetPositionY()

```
int32_t mage::Mouse::GetPositionY ( ) const
```

Returns the vertical position of this mouse.

Returns

The vertical position of this mouse.

5.67.3.7 InitializeMouse()

```
void mage::Mouse::InitializeMouse ( ) [private]
```

Initializes the mouse device of this mouse.

Exceptions

| | |
|---------------------------|---------------------------------|
| <i>FormattedException</i> | Failed to initialize the mouse. |
|---------------------------|---------------------------------|

5.67.3.8 operator=() [1/2]

```
Mouse& mage::Mouse::operator= (
    const Mouse & mouse ) [delete]
```

Copies the given mouse to this mouse.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>mouse</i> | A reference to the mouse to copy. |
|----|--------------|-----------------------------------|

Returns

A reference to the copy of the given mouse (i.e. this mouse).

5.67.3.9 operator=() [2/2]

```
Mouse& mage::Mouse::operator= (
    Mouse && mouse ) [delete]
```

Moves the given mouse to this mouse.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>mouse</i> | A reference to the mouse to move. |
|----|--------------|-----------------------------------|

Returns

A reference to the moved mouse (i.e. this mouse).

5.67.3.10 Update()

```
void mage::Mouse::Update ( )
```

Updates the state of this mouse.

5.67.4 Member Data Documentation**5.67.4.1 m_di**

```
IDirectInput8* const mage::Mouse::m_di [private]
```

A pointer to the DirectInput object of this mouse.

5.67.4.2 m_hwindow

```
const HWND mage::Mouse::m_hwindow [private]
```

The handle of the parent window of this mouse.

5.67.4.3 m_mouse

```
ComPtr< IDirectInputDevice8 > mage::Mouse::m_mouse [private]
```

A pointer to the DirectInput mouse device of this mouse.

5.67.4.4 m_mouse_button_press_stamp

```
uint64_t mage::Mouse::m_mouse_button_press_stamp[3] [mutable], [private]
```

The mouse button press stamp of this mouse.

Stamps the mouse buttons pressed in the last frame of this mouse.

5.67.4.5 m_mouse_position

```
POINT mage::Mouse::m_mouse_position [private]
```

The position of the mouse cursor on the screen of this mouse.

5.67.4.6 m_mouse_state

```
DIMOUSESTATE mage::Mouse::m_mouse_state [private]
```

The state of the mouse buttons of this mouse.

Describes the state of a mouse device that has up to four buttons, or another device that is being accessed as if it were a mouse device.

5.67.4.7 m_press_stamp

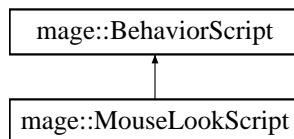
```
uint64_t mage::Mouse::m_press_stamp [private]
```

The current press stamp (incremented every frame) of this mouse.

5.68 mage::MouseLookScript Class Reference

```
#include <mouse_look_script.hpp>
```

Inheritance diagram for mage::MouseLookScript:



Public Member Functions

- `MouseLookScript (TransformNode *transform, RotationAxes axes=RotationAxes_MouseXAndY, const XMFLOAT2 &sensitivity=XMFLOAT2(1.8f, 1.8f), const XMFLOAT2 &minimum_rotation=XMFLOAT2(-XM_PI/3.0f, -XM_PI), const XMFLOAT2 &maximum_rotation=XMFLOAT2(XM_PI/3.0f, XM_PI), const XMFLOAT2 &direction=XMFLOAT2(1.0f, 1.0f))`
- `MouseLookScript (const MouseLookScript &script)=delete`
- `MouseLookScript (MouseLookScript &&script)`
- `virtual ~MouseLookScript ()`
- `MouseLookScript & operator= (const MouseLookScript &script)=delete`
- `MouseLookScript & operator= (MouseLookScript &&script)=delete`
- `virtual void Update (double delta_time) override`
- `RotationAxes GetRotationAxes () const`
- `void SetRotationAxes (RotationAxes axes)`
- `float GetSensitivityX () const`
- `float GetSensitivityY () const`
- `const XMVECTOR GetSensitivity () const`
- `void SetSensitivityX (float x)`
- `void SetSensitivityY (float y)`
- `void SetSensitivity (float x, float y)`
- `void SetSensitivity (const XMVECTOR &sensitivity)`
- `void SetSensitivity (const XMVECTOR &sensitivity)`
- `float GetMinimumRotationX () const`
- `float GetMinimumRotationY () const`
- `const XMVECTOR GetMinimumRotation () const`
- `void SetMinimumRotationX (float x)`
- `void SetMinimumRotationY (float y)`
- `void SetMinimumRotation (float x, float y)`
- `void SetMinimumRotation (const XMVECTOR &minimum_rotation)`
- `void SetMinimumRotation (const XMVECTOR &minimum_rotation)`
- `float GetMaximumRotationX () const`
- `float GetMaximumRotationY () const`
- `const XMVECTOR GetMaximumRotation () const`
- `void SetMaximumRotationX (float x)`
- `void SetMaximumRotationY (float y)`
- `void SetMaximumRotation (float x, float y)`
- `void SetMaximumRotation (const XMVECTOR &maximum_rotation)`
- `void SetMaximumRotation (const XMVECTOR &maximum_rotation)`
- `void InvertDirectionX ()`
- `void InvertDirectionY ()`

Private Attributes

- `TransformNode *const m_transform`
- `RotationAxes m_axes`
- `XMFLOAT2 m_sensitivity`
- `XMFLOAT2 m_minimum_rotation`
- `XMFLOAT2 m_maximum_rotation`
- `XMFLOAT2 m_direction`

Additional Inherited Members

5.68.1 Constructor & Destructor Documentation

5.68.1.1 MouseLookScript() [1/3]

```
mage::MouseLookScript::MouseLookScript (
    TransformNode * transform,
    RotationAxes axes = RotationAxes_MouseXAndY,
    const XMFLOAT2 & sensitivity = XMFLOAT2(1.8f, 1.8f),
    const XMFLOAT2 & minimum_rotation = XMFLOAT2(-XM_PI / 3.0f, -XM_PI),
    const XMFLOAT2 & maximum_rotation = XMFLOAT2(XM_PI / 3.0f, XM_PI),
    const XMFLOAT2 & direction = XMFLOAT2(1.0f, 1.0f) ) [explicit]
```

5.68.1.2 MouseLookScript() [2/3]

```
mage::MouseLookScript::MouseLookScript (
    const MouseLookScript & script ) [delete]
```

5.68.1.3 MouseLookScript() [3/3]

```
mage::MouseLookScript::MouseLookScript (
    MouseLookScript && script ) [default]
```

5.68.1.4 ~MouseLookScript()

```
mage::MouseLookScript::~MouseLookScript ( ) [virtual], [default]
```

5.68.2 Member Function Documentation

5.68.2.1 GetMaximumRotation()

```
const XMFLOAT2 mage::MouseLookScript::GetMaximumRotation ( ) const
```

5.68.2.2 GetMaximumRotationX()

```
float mage::MouseLookScript::GetMaximumRotationX ( ) const
```

5.68.2.3 GetMaximumRotationY()

```
float mage::MouseLookScript::GetMaximumRotationY ( ) const
```

5.68.2.4 GetMinimumRotation()

```
const XMFLOAT2 mage::MouseLookScript::GetMinimumRotation ( ) const
```

5.68.2.5 GetMinimumRotationX()

```
float mage::MouseLookScript::GetMinimumRotationX ( ) const
```

5.68.2.6 GetMinimumRotationY()

```
float mage::MouseLookScript::GetMinimumRotationY ( ) const
```

5.68.2.7 GetRotationAxes()

```
RotationAxes mage::MouseLookScript::GetRotationAxes ( ) const
```

5.68.2.8 GetSensitivity()

```
const XMFLOAT2 mage::MouseLookScript::GetSensitivity ( ) const
```

5.68.2.9 GetSensitivityX()

```
float mage::MouseLookScript::GetSensitivityX ( ) const
```

5.68.2.10 GetSensitivityY()

```
float mage::MouseLookScript::GetSensitivityY ( ) const
```

5.68.2.11 InvertDirectionX()

```
void mage::MouseLookScript::InvertDirectionX ( )
```

5.68.2.12 InvertDirectionY()

```
void mage::MouseLookScript::InvertDirectionY ( )
```

5.68.2.13 operator=() [1/2]

```
MouseLookScript& mage::MouseLookScript::operator= (
    const MouseLookScript & script ) [delete]
```

5.68.2.14 operator=() [2/2]

```
MouseLookScript& mage::MouseLookScript::operator= (
    MouseLookScript && script ) [delete]
```

5.68.2.15 SetMaximumRotation() [1/3]

```
void mage::MouseLookScript::SetMaximumRotation (
    float x,
    float y )
```

5.68.2.16 SetMaximumRotation() [2/3]

```
void mage::MouseLookScript::SetMaximumRotation (
    const XMFLOAT2 & maximum_rotation )
```

5.68.2.17 SetMaximumRotation() [3/3]

```
void mage::MouseLookScript::SetMaximumRotation (
    const XMVECTOR & maximum_rotation )
```

5.68.2.18 SetMaximumRotationX()

```
void mage::MouseLookScript::SetMaximumRotationX (
    float x )
```

5.68.2.19 SetMaximumRotationY()

```
void mage::MouseLookScript::SetMaximumRotationY (
    float y )
```

5.68.2.20 SetMinimumRotation() [1/3]

```
void mage::MouseLookScript::SetMinimumRotation (
    float x,
    float y )
```

5.68.2.21 SetMinimumRotation() [2/3]

```
void mage::MouseLookScript::SetMinimumRotation (
    const XMFLOAT2 & minimum_rotation )
```

5.68.2.22 SetMinimumRotation() [3/3]

```
void mage::MouseLookScript::SetMinimumRotation (
    const XMVECTOR & minimum_rotation )
```

5.68.2.23 SetMinimumRotationX()

```
void mage::MouseLookScript::SetMinimumRotationX (
    float x )
```

5.68.2.24 SetMinimumRotationY()

```
void mage::MouseLookScript::SetMinimumRotationY (
    float y )
```

5.68.2.25 SetRotationAxes()

```
void mage::MouseLookScript::SetRotationAxes (
    RotationAxes axes )
```

5.68.2.26 SetSensitivity() [1/3]

```
void mage::MouseLookScript::SetSensitivity (
    float x,
    float y )
```

5.68.2.27 SetSensitivity() [2/3]

```
void mage::MouseLookScript::SetSensitivity (
    const XMFLOAT2 & sensitivity )
```

5.68.2.28 SetSensitivity() [3/3]

```
void mage::MouseLookScript::SetSensitivity (
    const XMVECTOR & sensitivity )
```

5.68.2.29 SetSensitivityX()

```
void mage::MouseLookScript::SetSensitivityX (
    float x )
```

5.68.2.30 SetSensitivityY()

```
void mage::MouseLookScript::SetSensitivityY (
    float y )
```

5.68.2.31 Update()

```
void mage::MouseLookScript::Update (
    double delta_time ) [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.68.3 Member Data Documentation

5.68.3.1 m_axes

```
RotationAxes mage::MouseLookScript::m_axes [private]
```

5.68.3.2 m_direction

```
XMFLOAT2 mage::MouseLookScript::m_direction [private]
```

5.68.3.3 m_maximum_rotation

```
XMFLOAT2 mage::MouseLookScript::m_maximum_rotation [private]
```

5.68.3.4 m_minimum_rotation

```
XMFLOAT2 mage::MouseLookScript::m_minimum_rotation [private]
```

5.68.3.5 m_sensitivity

```
XMFLOAT2 mage::MouseLookScript::m_sensitivity [private]
```

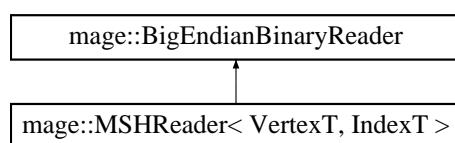
5.68.3.6 m_transform

```
TransformNode* const mage::MouseLookScript::m_transform [private]
```

5.69 mage::MSHReader< VertexT, IndexT > Class Template Reference

```
#include <msh_reader.hpp>
```

Inheritance diagram for mage::MSHReader< VertexT, IndexT >:



Public Member Functions

- `MSHReader (vector< VertexT > &vertices, vector< IndexT > &indices)`
- `MSHReader (const MSHReader &reader)=delete`
- `MSHReader (MSHReader &&reader)`
- `virtual ~MSHReader ()`
- `MSHReader & operator= (const MSHReader &reader)=delete`
- `MSHReader & operator= (MSHReader &&reader)=delete`

Private Member Functions

- `virtual void Read () override`
- `bool IsHeaderValid ()`

Private Attributes

- `vector< VertexT > & m_vertices`
- `vector< IndexT > & m_indices`

Additional Inherited Members

5.69.1 Detailed Description

```
template<typename VertexT, typename IndexT>
class mage::MSHReader< VertexT, IndexT >
```

A class of MSH file readers for reading meshes.

Template Parameters

| | |
|----------------------|------------------|
| <code>VertexT</code> | The vertex type. |
| <code>IndexT</code> | The index type. |

5.69.2 Constructor & Destructor Documentation

5.69.2.1 MSHReader() [1/3]

```
template<typename VertexT , typename IndexT >
mage::MSHReader< VertexT, IndexT >::MSHReader (
    vector< VertexT > & vertices,
    vector< IndexT > & indices ) [explicit]
```

Constructs a MSH reader.

Parameters

| | | |
|-----------------|-----------------------|--|
| <code>in</code> | <code>vertices</code> | A reference to a vector for storing the read vertices from file. |
| <code>in</code> | <code>indices</code> | A reference to a vector for storing the read indices from file. |

5.69.2.2 MSHReader() [2/3]

```
template<typename VertexT , typename IndexT >
mage::MSHReader< VertexT, IndexT >::MSHReader (
    const MSHReader< VertexT, IndexT > & reader ) [delete]
```

Constructs a MSH reader from the given MSH reader.

Parameters

| | | |
|----|---------------|--|
| in | <i>reader</i> | A reference to the MSH reader to copy. |
|----|---------------|--|

5.69.2.3 MSHReader() [3/3]

```
template<typename VertexT , typename IndexT >
mage::MSHReader< VertexT, IndexT >::MSHReader (
    MSHReader< VertexT, IndexT > && reader )
```

Constructs a MSH reader by moving the given MSH reader.

Parameters

| | | |
|----|---------------|--|
| in | <i>reader</i> | A reference to the MSH reader to move. |
|----|---------------|--|

5.69.2.4 ~MSHReader()

```
template<typename VertexT , typename IndexT >
virtual mage::MSHReader< VertexT, IndexT >::~MSHReader ( ) [virtual]
```

Destructs this MSH reader.

5.69.3 Member Function Documentation

5.69.3.1 IsHeaderValid()

```
template<typename VertexT , typename IndexT >
bool mage::MSHReader< VertexT, IndexT >::IsHeaderValid ( ) [private]
```

Checks whether the header of the file is valid.

Returns

`true` if the header of the file is valid. `false` otherwise.

5.69.3.2 operator=() [1/2]

```
template<typename VertexT , typename IndexT >
MSHReader& mage::MSHReader< VertexT, IndexT >::operator= (
    const MSHReader< VertexT, IndexT > & reader ) [delete]
```

Copies the given MSH reader to this MSH reader.

Parameters

| | | |
|----|---------------|--------------------------------------|
| in | <i>reader</i> | A reference to a MSH reader to copy. |
|----|---------------|--------------------------------------|

Returns

A reference to the copy of the given MSH reader (i.e. this MSH reader).

5.69.3.3 operator=() [2/2]

```
template<typename VertexT , typename IndexT >
MSHReader& mage::MSHReader< VertexT, IndexT >::operator= (
    MSHReader< VertexT, IndexT > && reader ) [delete]
```

Moves the given MSH reader to this MSH reader.

Parameters

| | | |
|----|---------------|--------------------------------------|
| in | <i>reader</i> | A reference to a MSH reader to move. |
|----|---------------|--------------------------------------|

Returns

A reference to the moved MSH reader (i.e. this MSH reader).

5.69.3.4 Read()

```
template<typename VertexT , typename IndexT >
virtual void mage::MSHReader< VertexT, IndexT >::Read ( ) [override], [private], [virtual]
```

Starts reading.

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to read to the given file. |
|---------------------------|-----------------------------------|

Implements [mage::BigEndianBinaryReader](#).

5.69.4 Member Data Documentation**5.69.4.1 m_indices**

```
template<typename VertexT , typename IndexT >
vector< IndexT >& mage::MSHReader< VertexT, IndexT >::m_indices [private]
```

A reference to a vector containing the read indices of this MSH reader.

5.69.4.2 m_vertices

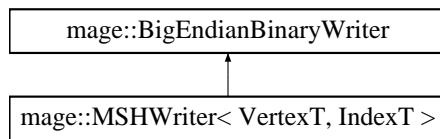
```
template<typename VertexT , typename IndexT >
vector< VertexT >& mage::MSHReader< VertexT, IndexT >::m_vertices [private]
```

A reference to a vector containing the read vertices of this MSH reader.

5.70 mage::MSHWriter< VertexT, IndexT > Class Template Reference

```
#include <msh_writer.hpp>
```

Inheritance diagram for mage::MSHWriter< VertexT, IndexT >:



Public Member Functions

- [MSHWriter](#) (const vector< VertexT > &vertices, const vector< IndexT > &indices)
- [MSHWriter](#) (const [MSHWriter](#) &writer)=delete
- [MSHWriter](#) ([MSHWriter](#) &&writer)
- virtual [~MSHWriter](#) ()
- [MSHWriter & operator=](#) (const [MSHWriter](#) &writer)=delete
- [MSHWriter & operator=](#) ([MSHWriter](#) &&writer)=delete

Private Member Functions

- virtual void [Write](#) () override

Private Attributes

- const vector< VertexT > & [m_vertices](#)
- const vector< IndexT > & [m_indices](#)

Additional Inherited Members

5.70.1 Detailed Description

```
template<typename VertexT, typename IndexT>
class mage::MSHWriter< VertexT, IndexT >
```

A class of MSH file writers for writing meshes.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
| <i>IndexT</i> | The index type. |

5.70.2 Constructor & Destructor Documentation

5.70.2.1 MSHWriter() [1/3]

```
template<typename VertexT , typename IndexT >
mage::MSHWriter< VertexT, IndexT >::MSHWriter (
    const vector< VertexT > & vertices,
    const vector< IndexT > & indices ) [explicit]
```

Constructs a MSH writer.

Parameters

| | | |
|----|-----------------|--|
| in | <i>vertices</i> | A reference to a vector containing the vertices. |
| in | <i>indices</i> | A reference to a vector containing the indices. |

5.70.2.2 MSHWriter() [2/3]

```
template<typename VertexT , typename IndexT >
mage::MSHWriter< VertexT, IndexT >::MSHWriter (
    const MSHWriter< VertexT, IndexT > & writer ) [delete]
```

Constructs a MSH writer from the given MSH writer.

Parameters

| | | |
|----|---------------|--|
| in | <i>writer</i> | A reference to the MSH writer to copy. |
|----|---------------|--|

5.70.2.3 MSHWriter() [3/3]

```
template<typename VertexT , typename IndexT >
mage::MSHWriter< VertexT, IndexT >::MSHWriter (
    MSHWriter< VertexT, IndexT > && writer )
```

Constructs a MSH writer by moving the given MSH writer.

Parameters

| | | |
|----|---------------|--|
| in | <i>writer</i> | A reference to the MSH writer to move. |
|----|---------------|--|

5.70.2.4 ~MSHWriter()

```
template<typename VertexT , typename IndexT >
virtual mage::MSHWriter< VertexT, IndexT >::~MSHWriter ( ) [virtual]
```

Destructs this MSH writer.

5.70.3 Member Function Documentation

5.70.3.1 operator=() [1/2]

```
template<typename VertexT , typename IndexT >
MSHWriter& mage::MSHWriter< VertexT, IndexT >::operator= (
    const MSHWriter< VertexT, IndexT > & writer ) [delete]
```

Copies the given MSH writer to this MSH writer.

Parameters

| | | |
|----|---------------|--------------------------------------|
| in | <i>writer</i> | A reference to a MSH writer to copy. |
|----|---------------|--------------------------------------|

Returns

A reference to the copy of the given MSH writer (i.e. this MSH writer).

5.70.3.2 operator=() [2/2]

```
template<typename VertexT , typename IndexT >
MSHWriter& mage::MSHWriter< VertexT, IndexT >::operator= (
    MSHWriter< VertexT, IndexT > && writer ) [delete]
```

Moves the given MSH writer to this MSH writer.

Parameters

| | | |
|----|---------------|--------------------------------------|
| in | <i>writer</i> | A reference to a MSH writer to move. |
|----|---------------|--------------------------------------|

Returns

A reference to the moved MSH writer (i.e. this MSH writer).

5.70.3.3 Write()

```
template<typename VertexT , typename IndexT >
virtual void mage::MSHWriter< VertexT, IndexT >::Write ( ) [override], [private], [virtual]
```

Starts writing.

Exceptions

| | |
|---------------------------|------------------|
| <i>FormattedException</i> | Failed to write. |
|---------------------------|------------------|

Implements [mage::BigEndianBinaryWriter](#).

5.70.4 Member Data Documentation

5.70.4.1 m_indices

```
template<typename VertexT , typename IndexT >
const vector< IndexT >& mage::MSHWriter< VertexT, IndexT >::m_indices [private]
```

A reference to a vector containing the indices to write by this VS writer.

5.70.4.2 m_vertices

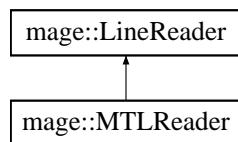
```
template<typename VertexT , typename IndexT >
const vector< VertexT >& mage::MSHWriter< VertexT, IndexT >::m_vertices [private]
```

A reference to a vector containing the vertices to write by this VS writer.

5.71 mage::MTLReader Class Reference

```
#include <mtl_reader.hpp>
```

Inheritance diagram for [mage::MTLReader](#):



Public Member Functions

- [MTLReader \(vector< Material > &material_buffer\)](#)
- [MTLReader \(const MTLReader &reader\)=delete](#)
- [MTLReader \(MTLReader &&reader\)](#)
- [virtual ~MTLReader \(\)](#)
- [MTLReader & operator= \(const MTLReader &reader\)=delete](#)
- [MTLReader & operator= \(MTLReader &&reader\)=delete](#)

Private Member Functions

- virtual void `ReadLine` (char *line) override
- void `ReadMTLMaterialName` ()
- void `ReadMTLTransmissionFilter` ()
- void `ReadMTLAmbientReflectivity` ()
- void `ReadMTLDiffuseReflectivity` ()
- void `ReadMTLSpecularReflectivity` ()
- void `ReadMTLSpecularExponent` ()
- void `ReadMTLDissolve` ()
- void `ReadMTLOpticalDensity` ()
- void `ReadMTLAmbientReflectivityTexture` ()
- void `ReadMTLDiffuseReflectivityTexture` ()
- void `ReadMTLSpecularReflectivityTexture` ()
- void `ReadMTLSpecularExponentTexture` ()
- void `ReadMTLDissolveTexture` ()
- void `ReadMTLDecalTexture` ()
- void `ReadMTLDisplacementTexture` ()
- void `ReadMTLBumpTexture` ()
- void `ReadMTLIlluminationModel` ()
- const `RGBSpectrum` `ReadMTLSpectrum` ()
- `SharedPtr< Texture >` `ReadMTLTexture` ()

Private Attributes

- `vector< Material > & m_material_buffer`

Additional Inherited Members

5.71.1 Detailed Description

A class of MTL file readers for reading materials.

5.71.2 Constructor & Destructor Documentation

5.71.2.1 `MTLReader()` [1/3]

```
mage::MTLReader::MTLReader (
    vector< Material > & material_buffer ) [explicit]
```

A construct a MTL reader.

Parameters

| | | |
|----|------------------------------|---|
| in | <code>material_buffer</code> | A reference to a vector for storing the read materials from file. |
|----|------------------------------|---|

5.71.2.2 MTLReader() [2/3]

```
mage::MTLReader::MTLReader (
    const MTLReader & reader ) [delete]
```

Constructs a MTL reader from the given MTL reader.

Parameters

| | | |
|----|--------|--|
| in | reader | A reference to the MTL reader to copy. |
|----|--------|--|

5.71.2.3 MTLReader() [3/3]

```
mage::MTLReader::MTLReader (
    MTLReader && reader ) [default]
```

Constructs a MTL reader by moving the given MTL reader.

Parameters

| | | |
|----|--------|--|
| in | reader | A reference to the MTL reader to move. |
|----|--------|--|

5.71.2.4 ~MTLReader()

```
mage::MTLReader::~MTLReader ( ) [virtual], [default]
```

Destructs this MTL reader.

5.71.3 Member Function Documentation

5.71.3.1 operator=() [1/2]

```
MTLReader& mage::MTLReader::operator= (
    const MTLReader & reader ) [delete]
```

Copies the given MTL reader to this MTL reader.

Parameters

| | | |
|----|--------|--------------------------------------|
| in | reader | A reference to a MTL reader to copy. |
|----|--------|--------------------------------------|

Returns

A reference to the copy of the given MTL reader (i.e. this MTL reader).

5.71.3.2 operator=() [2/2]

```
MTLReader& mage::MTLReader::operator= (
    MTLReader && reader ) [delete]
```

Moves the given MTL reader to this MTL reader.

Parameters

| | | |
|----|--------|--------------------------------------|
| in | reader | A reference to a MTL reader to move. |
|----|--------|--------------------------------------|

Returns

A reference to the moved MTL reader (i.e. this MTL reader).

5.71.3.3 ReadLine()

```
void mage::MTLReader::ReadLine (
    char * line ) [override], [private], [virtual]
```

Reads the given line.

Precondition

line is not equal to `nullptr`.

Parameters

| | | |
|---------|------|---|
| in, out | line | A pointer to the null-terminated byte string to read. |
|---------|------|---|

Exceptions

| | |
|--------------------|--------------------------------|
| FormattedException | Failed to read the given line. |
|--------------------|--------------------------------|

Implements [mage::LineReader](#).

5.71.3.4 ReadMTLAmbientReflectivity()

```
void mage::MTLReader::ReadMTLAmbientReflectivity ( ) [private]
```

Reads an Ambient Reflectivity definition.

Exceptions

| | |
|--------------------|--|
| FormattedException | Failed to read an Ambient Reflectivity definition. |
|--------------------|--|

5.71.3.5 ReadMTLAmbientReflectivityTexture()

```
void mage::MTLReader::ReadMTLAmbientReflectivityTexture ( ) [private]
```

Reads an Ambient Reflectivity [Texture](#) definition.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read Ambient Reflectivity Texture definition. |
|---------------------------|---|

5.71.3.6 ReadMTLBumpTexture()

```
void mage::MTLReader::ReadMTLBumpTexture ( ) [private]
```

Reads a Bump [Texture](#) definition.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a Bump Texture definition. |
|---------------------------|---|

5.71.3.7 ReadMTLDecalTexture()

```
void mage::MTLReader::ReadMTLDecalTexture ( ) [private]
```

Reads a Decal [Texture](#) definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Decal Texture definition. |
|---------------------------|--|

5.71.3.8 ReadMTLDiffuseReflectivity()

```
void mage::MTLReader::ReadMTLDiffuseReflectivity ( ) [private]
```

Reads a Diffuse Reflectivity definition.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a Diffuse Reflectivity definition. |
|---------------------------|---|

5.71.3.9 ReadMTLDiffuseReflectivityTexture()

```
void mage::MTLReader::ReadMTLDiffuseReflectivityTexture ( ) [private]
```

Reads a Diffuse Reflectivity [Texture](#) definition.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a Diffuse Reflectivity Texture definition. |
|---------------------------|---|

5.71.3.10 ReadMTLDisplacementTexture()

```
void mage::MTLReader::ReadMTLDisplacementTexture ( ) [private]
```

Reads a Displacement [Texture](#) definition.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a Displacement Texture definition. |
|---------------------------|---|

5.71.3.11 ReadMTLDissolve()

```
void mage::MTLReader::ReadMTLDissolve ( ) [private]
```

Reads a Dissolve definition.

Exceptions

| | |
|---------------------------|---------------------------------------|
| <i>FormattedException</i> | Failed to read a Dissolve definition. |
|---------------------------|---------------------------------------|

5.71.3.12 ReadMTLDissolveTexture()

```
void mage::MTLReader::ReadMTLDissolveTexture ( ) [private]
```

Reads a Dissolve [Texture](#) definition.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a Dissolve Texture definition. |
|---------------------------|---|

5.71.3.13 ReadMTLIlluminationModel()

```
void mage::MTLReader::ReadMTLIlluminationModel ( ) [private]
```

Reads an Illumination [Model](#) definition.

Note

An illumination model is, if present, silently ignored.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read an Illumination Model definition. |
|---------------------------|--|

5.71.3.14 ReadMTLMaterialName()

```
void mage::MTLReader::ReadMTLMaterialName ( ) [private]
```

Reads a [Material](#) Name definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Material Name definition. |
|---------------------------|--|

5.71.3.15 ReadMTLOpticalDensity()

```
void mage::MTLReader::ReadMTLOpticalDensity ( ) [private]
```

Reads an Optical Density definition.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read an Optical Density definition. |
|---------------------------|---|

5.71.3.16 ReadMTLSpectrum()

```
const RGBSpectrum mage::MTLReader::ReadMTLSpectrum ( ) [private]
```

Reads an RGB spectrum.

Returns

The [RGBSpectrum](#) represented by the next token of this MTL reader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a RGBSpectrum . |
|---------------------------|--|

5.71.3.17 ReadMTLSpecularExponent()

```
void mage::MTLReader::ReadMTLSpecularExponent ( ) [private]
```

Reads a Specular Exponent definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Specular Exponent definition. |
|---------------------------|--|

5.71.3.18 ReadMTLSpecularExponentTexture()

```
void mage::MTLReader::ReadMTLSpecularExponentTexture () [private]
```

Reads a Specular Exponent [Texture](#) definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Specular Exponent Texture definition. |
|---------------------------|--|

5.71.3.19 ReadMTLSpecularReflectivity()

```
void mage::MTLReader::ReadMTLSpecularReflectivity () [private]
```

Reads a Specular Reflectivity definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Specular Reflectivity definition. |
|---------------------------|--|

5.71.3.20 ReadMTLSpecularReflectivityTexture()

```
void mage::MTLReader::ReadMTLSpecularReflectivityTexture () [private]
```

Reads a Specular Reflectivity [Texture](#) definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Specular Reflectivity Texture definition. |
|---------------------------|--|

5.71.3.21 ReadMTLTexture()

```
SharedPtr< Texture > mage::MTLReader::ReadMTLTexture () [private]
```

Reads a texture.

Returns

A pointer to the texture represented by the next token of this MTL reader.

Exceptions

| | |
|---------------------------|---------------------------|
| <i>FormattedException</i> | Failed to read a texture. |
|---------------------------|---------------------------|

5.71.3.22 ReadMTLTransmissionFilter()

```
void mage::MTLReader::ReadMTLTransmissionFilter( ) [private]
```

Reads a Transmission Filter definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Transmission Filter definition. |
|---------------------------|--|

5.71.4 Member Data Documentation**5.71.4.1 m_material_buffer**

```
vector< Material >& mage::MTLReader::m_material_buffer [private]
```

A reference to a vector containing the read materials of this MTL reader.

5.72 mage::Mutex Struct Reference

```
#include <lock.hpp>
```

Public Member Functions

- [Mutex \(\)](#)
- [Mutex \(const Mutex &mutex\)=delete](#)
- [Mutex \(Mutex &&mutex\)=default](#)
- [~Mutex \(\)](#)
- [Mutex & operator= \(const Mutex &mutex\)=delete](#)
- [Mutex & operator= \(Mutex &&mutex\)=delete](#)

Private Attributes

- CRITICAL_SECTION [m_critical_section](#)

Friends

- struct [MutexLock](#)

5.72.1 Detailed Description

A struct of mutexes.

5.72.2 Constructor & Destructor Documentation

5.72.2.1 Mutex() [1/3]

```
mage::Mutex::Mutex ( )
```

Constructs a mutex.

5.72.2.2 Mutex() [2/3]

```
mage::Mutex::Mutex ( const Mutex & mutex ) [delete]
```

Constructs a mutex from the given mutex.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>mutex</i> | A reference to the mutex to copy. |
|----|--------------|-----------------------------------|

5.72.2.3 Mutex() [3/3]

```
mage::Mutex::Mutex ( Mutex && mutex ) [default]
```

Constructs a mutex by moving the given mutex.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>mutex</i> | A reference to the mutex to move. |
|----|--------------|-----------------------------------|

5.72.2.4 ~Mutex()

```
mage::Mutex::~Mutex ( )
```

Destructs this mutex.

5.72.3 Member Function Documentation

5.72.3.1 operator=() [1/2]

```
Mutex& mage::Mutex::operator= ( const Mutex & mutex ) [delete]
```

Copies the given mutex to this mutex.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>mutex</i> | A reference to the mutex to copy. |
|----|--------------|-----------------------------------|

Returns

A reference to the copy of the given mutex (i.e. this mutex).

5.72.3.2 operator=() [2/2]

```
Mutex& mage::Mutex::operator= (
    Mutex && mutex ) [delete]
```

Moves the given mutex to this mutex.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>mutex</i> | A reference to the mutex to move. |
|----|--------------|-----------------------------------|

Returns

A reference to the moved mutex (i.e. this mutex).

5.72.4 Friends And Related Function Documentation**5.72.4.1 MutexLock**

```
friend struct MutexLock [friend]
```

5.72.5 Member Data Documentation**5.72.5.1 m_critical_section**

```
CRITICAL_SECTION mage::Mutex::m_critical_section [private]
```

The critical section object of this mutex.

5.73 mage::MutexLock Struct Reference

```
#include <lock.hpp>
```

Public Member Functions

- `MutexLock (Mutex &mutex)`
- `MutexLock (const MutexLock &mutex_lock)=delete`
- `MutexLock (MutexLock &&mutex_lock)=default`
- `~MutexLock ()`
- `MutexLock & operator= (const MutexLock &mutex_lock)=delete`
- `MutexLock & operator= (MutexLock &&mutex_lock)=delete`

Private Attributes

- `Mutex & m_mutex`

5.73.1 Detailed Description

A struct of mutex locks.

5.73.2 Constructor & Destructor Documentation

5.73.2.1 MutexLock() [1/3]

```
mage::MutexLock::MutexLock (
    Mutex & mutex ) [explicit]
```

Constructs a mutex lock for the given mutex.

Parameters

| | | |
|----|--------------------|---------------------------|
| in | <code>mutex</code> | A reference to the mutex. |
|----|--------------------|---------------------------|

5.73.2.2 MutexLock() [2/3]

```
mage::MutexLock::MutexLock (
    const MutexLock & mutex_lock ) [delete]
```

Constructs a mutex lock from the given mutex lock.

Parameters

| | | |
|----|-------------------------|--|
| in | <code>mutex_lock</code> | A reference to the mutex lock to copy. |
|----|-------------------------|--|

5.73.2.3 MutexLock() [3/3]

```
mage::MutexLock::MutexLock (
    MutexLock && mutex_lock ) [default]
```

Constructs a mutex lock by moving the given mutex lock.

Parameters

| | | |
|----|-------------------|--|
| in | <i>mutex_lock</i> | A reference to the mutex lock to move. |
|----|-------------------|--|

5.73.2.4 ~MutexLock()

```
mage::MutexLock::~MutexLock ( )
```

Destructs this mutex lock.

5.73.3 Member Function Documentation**5.73.3.1 operator=() [1/2]**

```
MutexLock& mage::MutexLock::operator= (
    const MutexLock & mutex_lock ) [delete]
```

Copies the given mutex lock to this mutex lock.

Parameters

| | | |
|----|-------------------|--|
| in | <i>mutex_lock</i> | A reference to the mutex lock to copy. |
|----|-------------------|--|

Returns

A reference to the copy of the given mutex lock (i.e. this mutex lock)

5.73.3.2 operator=() [2/2]

```
MutexLock& mage::MutexLock::operator= (
    MutexLock && mutex_lock ) [delete]
```

Moves the given mutex lock to this mutex lock.

Parameters

| | | |
|----|-------------------|--|
| in | <i>mutex_lock</i> | A reference to the mutex lock to move. |
|----|-------------------|--|

Returns

A reference to the moved mutex lock (i.e. this mutex lock)

5.73.4 Member Data Documentation

5.73.4.1 m_mutex

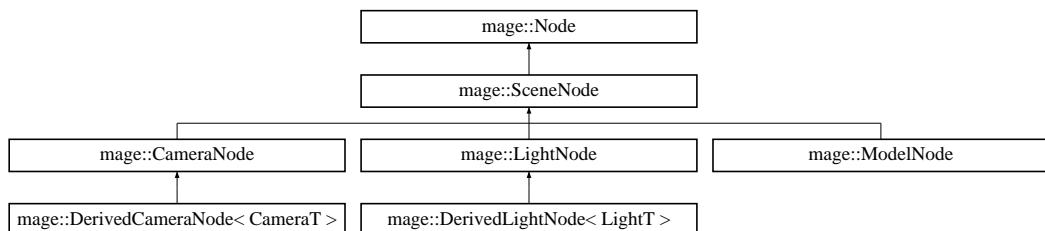
```
Mutex& mage::MutexLock::m_mutex [private]
```

A reference to the mutex of this mutex lock.

5.74 mage::Node Class Reference

```
#include <transform_node.hpp>
```

Inheritance diagram for mage::Node:



Public Member Functions

- [Node \(\)](#)
- [Node \(const Node &node\)](#)
- [Node \(Node &&node\)](#)
- [virtual ~Node \(\)](#)
- [Node & operator= \(const Node &node\)=delete](#)
- [Node & operator= \(Node &&node\)=delete](#)
- [UniquePtr< Node > Clone \(\) const](#)
- [TransformNode * GetTransform \(\)](#)
- [const TransformNode * GetTransform \(\) const](#)
- [bool IsActive \(\) const](#)
- [bool IsPassive \(\) const](#)
- [void MakeActive \(\)](#)
- [void MakePassive \(\)](#)
- [void SetActive \(bool active\)](#)
- [bool HasParentNode \(\) const](#)
- [Node * GetParentNode \(\) const](#)
- [size_t GetNumberOfChildNodes \(\) const](#)
- [bool HasChildNode \(SharedPtr< const Node > node\) const](#)
- [void AddChildNode \(SharedPtr< Node > node\)](#)
- [void RemoveChildNode \(SharedPtr< Node > node\)](#)
- [void RemoveAllChildNodes \(\)](#)
- [template<typename ActionT> void ForEachChildNode \(ActionT action\) const](#)
- [template<typename ActionT> void ForEachDescendantNode \(ActionT action\) const](#)

Private Member Functions

- [virtual UniquePtr< Node > CloneImplementation \(\) const](#)

Private Attributes

- `UniquePtr< TransformNode > m_transform`
- `bool m_active`

5.74.1 Detailed Description

A class of nodes.

5.74.2 Constructor & Destructor Documentation

5.74.2.1 `Node()` [1/3]

```
mage::Node::Node ( )
```

Constructs a node.

5.74.2.2 `Node()` [2/3]

```
mage::Node::Node ( const Node & node )
```

Constructs a node from the given node.

Parameters

| | | |
|----|-------------------|--------------------------|
| in | <code>node</code> | A reference to the node. |
|----|-------------------|--------------------------|

5.74.2.3 `Node()` [3/3]

```
mage::Node::Node ( Node && node ) [default]
```

Constructs a node by moving the given node.

Parameters

| | | |
|----|-------------------|----------------------------------|
| in | <code>node</code> | A reference to the node to move. |
|----|-------------------|----------------------------------|

5.74.2.4 `~Node()`

```
mage::Node::~Node ( ) [virtual], [default]
```

Destructs this node.

5.74.3 Member Function Documentation

5.74.3.1 AddChildNode()

```
void mage::Node::AddChildNode (   
    SharedPtr< Node > node )
```

Adds the given node to the child nodes of this node.

Parameters

| | | |
|----|-------------|-------------------------------|
| in | <i>node</i> | A pointer to the node to add. |
|----|-------------|-------------------------------|

5.74.3.2 Clone()

```
UniquePtr< Node > mage::Node::Clone ( ) const
```

Clones this node.

Returns

A pointer to the clone of this node.

5.74.3.3 ClonImplementation()

```
UniquePtr< Node > mage::Node::CloneImplementation ( ) const [private], [virtual]
```

Clones this node.

Returns

A pointer to the clone of this node.

Reimplemented in [mage::DerivedLightNode< LightT >](#), [mage::DerivedCameraNode< CameraT >](#), [mage::LightNode](#), [mage::CameraNode](#), [mage::ModelNode](#), and [mage::SceneNode](#).

5.74.3.4 ForEachChildNode()

```
template<typename ActionT >  
void mage::Node::ForEachChildNode (   
    ActionT action ) const
```

Traverses all child nodes of this node.

Template Parameters

| | |
|---------|--|
| ActionT | An action to perform on all child nodes of this node. The action must accept (const) <code>Node</code> & values. |
|---------|--|

5.74.3.5 `ForEachDescendantNode()`

```
template<typename ActionT >
void mage::Node::ForEachDescendantNode (
    ActionT action ) const
```

Traverses all descendant (childs included) nodes of this transform node.

Template Parameters

| | |
|----------------------|---|
| <code>ActionT</code> | An action to perform on all descendant nodes of this node. The action must accept (const) <code>Node</code> & values. |
|----------------------|---|

5.74.3.6 `GetNumberOfChildNodes()`

```
size_t mage::Node::GetNumberOfChildNodes ( ) const
```

Returns the number of child nodes of this node.

Returns

The number of child nodes of this node.

5.74.3.7 `GetParentNode()`

```
Node* mage::Node::GetParentNode ( ) const
```

Returns the parent node of this node.

Returns

`nullptr` if this node has no parent node.
A pointer to the parent node of this node.

5.74.3.8 `GetTransform()` [1/2]

```
TransformNode* mage::Node::GetTransform ( )
```

Returns the transform of this node.

Returns

A pointer to the transform of this node.

5.74.3.9 GetTransform() [2/2]

```
const TransformNode* mage::Node::GetTransform ( ) const
```

Returns the transform of this node.

Returns

A pointer to the transform of this node.

5.74.3.10 HasChildNode()

```
bool mage::Node::HasChildNode (   
    SharedPtr< const Node > node ) const
```

Checks whether this node contains the given node as a child node.

Parameters

| | | |
|----|-------------|------------------------|
| in | <i>node</i> | A pointer to the node. |
|----|-------------|------------------------|

Returns

true if this node contains the given node as a child node. false otherwise.

5.74.3.11 HasparentNode()

```
bool mage::Node::HasparentNode ( ) const
```

Checks whether this node has a parent node.

Returns

true if this node has a parent node. false otherwise.

5.74.3.12 IsActive()

```
bool mage::Node::IsActive ( ) const
```

Checks whether this node is active.

Returns

true if this node is active. false otherwise (i.e. passive).

5.74.3.13 IsPassive()

```
bool mage::Node::IsPassive ( ) const
```

Checks whether this node is passive.

Returns

true if this node is passive. false otherwise (i.e. active).

5.74.3.14 MakeActive()

```
void mage::Node::MakeActive ( )
```

Makes this node (and its descendant nodes) active.

5.74.3.15 MakePassive()

```
void mage::Node::MakePassive ( )
```

Makes this node (and its descendant nodes) passive.

5.74.3.16 operator=() [1/2]

```
Node& mage::Node::operator= (
    const Node & node ) [delete]
```

Copies the given node to this node.

Parameters

| | | |
|----|-------------|----------------------------------|
| in | <i>node</i> | A reference to the node to copy. |
|----|-------------|----------------------------------|

Returns

A reference to the copy of the given node (i.e. this node).

5.74.3.17 operator=() [2/2]

```
Node& mage::Node::operator= (
    Node && node ) [delete]
```

Moves the given node to this node.

Parameters

| | | |
|----|-------------|----------------------------------|
| in | <i>node</i> | A reference to the node to move. |
|----|-------------|----------------------------------|

Returns

A reference to the moved node (i.e. this node).

5.74.3.18 RemoveAllChildNodes()

```
void mage::Node::RemoveAllChildNodes ( )
```

Removes all child nodes from this node.

5.74.3.19 RemoveChildNode()

```
void mage::Node::RemoveChildNode (
    SharedPtr< Node > node )
```

Removes the given node from the child nodes of this node.

Parameters

| | | |
|----|-------------|----------------------------------|
| in | <i>node</i> | A pointer to the node to remove. |
|----|-------------|----------------------------------|

5.74.3.20 SetActive()

```
void mage::Node::SetActive (
    bool active )
```

Sets this node active flag to the given value.

Parameters

| | | |
|----|---------------|------------------|
| in | <i>active</i> | The active flag. |
|----|---------------|------------------|

5.74.4 Member Data Documentation**5.74.4.1 m_active**

```
bool mage::Node::m_active [private]
```

A flag indicating whether this node is active or not (i.e. passive).

5.74.4.2 m_transform

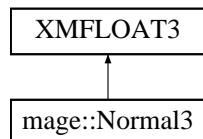
```
UniquePtr< TransformNode > mage::Node::m_transform [private]
```

A pointer to the transform of this node.

5.75 mage::Normal3 Struct Reference

```
#include <math.hpp>
```

Inheritance diagram for mage::Normal3:

**Public Member Functions**

- [Normal3 \(\)](#)
- [Normal3 \(float x, float y, float z\)](#)
- [Normal3 \(const Normal3 &normal\)](#)
- [Normal3 \(Normal3 &&normal\)](#)
- [Normal3 \(const Direction3 &direction\)](#)
- [Normal3 \(Direction3 &&direction\)](#)
- [Normal3 \(const XMFLOAT3 &v\)](#)
- [Normal3 \(XMFLOAT3 &&v\)](#)
- [~Normal3 \(\)=default](#)
- [Normal3 & operator= \(const Normal3 &normal\)](#)
- [Normal3 & operator= \(Normal3 &&normal\)](#)

5.75.1 Detailed Description

A struct of normals in 3D space.

Note

`Normal3` does not guarantee or force normalized directions. This should be guaranteed and enforced by the user.

5.75.2 Constructor & Destructor Documentation

5.75.2.1 Normal3() [1/8]

```
mage::Normal3::Normal3 ( )
```

Constructs a normal.

5.75.2.2 Normal3() [2/8]

```
mage::Normal3::Normal3 (
    float x,
    float y,
    float z )
```

Constructs a normal from the given coordinates.

Parameters

| | | |
|----|---|-------------------|
| in | x | The x-coordinate. |
| in | y | The y-coordinate. |
| in | z | The z-coordinate. |

5.75.2.3 Normal3() [3/8]

```
mage::Normal3::Normal3 (
    const Normal3 & normal )
```

Constructs a normal from the given normal.

Parameters

| | | |
|----|--------|------------------------------------|
| in | normal | A reference to the normal to copy. |
|----|--------|------------------------------------|

5.75.2.4 Normal3() [4/8]

```
mage::Normal3::Normal3 (
    Normal3 && normal )
```

Constructs a normal by moving the given normal.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>normal</i> | A reference to the normal to move. |
|----|---------------|------------------------------------|

5.75.2.5 Normal3() [5/8]

```
mage::Normal3::Normal3 (
    const Direction3 & direction ) [explicit]
```

Constructs a normal from the given direction.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>direction</i> | A reference to the direction to copy. |
|----|------------------|---------------------------------------|

5.75.2.6 Normal3() [6/8]

```
mage::Normal3::Normal3 (
    Direction3 && direction ) [explicit]
```

Constructs a normal by moving the given direction.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>direction</i> | A reference to the direction to move. |
|----|------------------|---------------------------------------|

5.75.2.7 Normal3() [7/8]

```
mage::Normal3::Normal3 (
    const XMFLOAT3 & v ) [explicit]
```

Constructs a normal from the given vector.

Parameters

| | | |
|----|----------|------------------------------------|
| in | <i>v</i> | A reference to the vector to copy. |
|----|----------|------------------------------------|

5.75.2.8 Normal3() [8/8]

```
mage::Normal3::Normal3 (
    XMFLOAT3 && v ) [explicit]
```

Constructs a normal by moving the given vector.

Parameters

| | | |
|----|---|------------------------------------|
| in | v | A reference to the vector to move. |
|----|---|------------------------------------|

5.75.2.9 ~Normal3()

```
mage::Normal3::~Normal3 ( ) [default]
```

Destructs this normal.

5.75.3 Member Function Documentation**5.75.3.1 operator=() [1/2]**

```
Normal3& mage::Normal3::operator= (
    const Normal3 & normal )
```

Copies the given normal to this normal.

Parameters

| | | |
|----|--------|------------------------------------|
| in | normal | A reference to the normal to copy. |
|----|--------|------------------------------------|

Returns

A reference to the copy of the given normal (i.e. this normal).

5.75.3.2 operator=() [2/2]

```
Normal3& mage::Normal3::operator= (
    Normal3 && normal )
```

Moves the given normal to this normal.

Parameters

| | | |
|----|--------|------------------------------------|
| in | normal | A reference to the normal to move. |
|----|--------|------------------------------------|

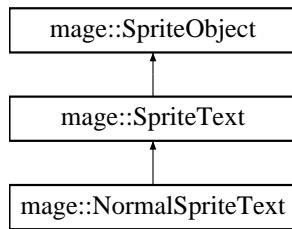
Returns

A reference to the moved normal (i.e. this normal).

5.76 mage::NormalSpriteText Class Reference

```
#include <normal_sprite_text.hpp>
```

Inheritance diagram for mage::NormalSpriteText:



Public Member Functions

- `NormalSpriteText (const string &name, SharedPtr< SpriteFont > font, SpriteEffect effects=SpriteEffect_None)`
- `NormalSpriteText (const NormalSpriteText &sprite_text)`
- `NormalSpriteText (NormalSpriteText &&sprite_text)`
- `virtual ~NormalSpriteText ()`
- `NormalSpriteText & operator= (const NormalSpriteText &sprite_text)=delete`
- `NormalSpriteText & operator= (NormalSpriteText &&sprite_text)=delete`
- `UniquePtr< NormalSpriteText > Clone () const`
- `virtual void Draw (SpriteBatch &sprite_batch) const override`

Private Member Functions

- `virtual UniquePtr< SpriteObject > ClonelImplementation () const override`

Additional Inherited Members

5.76.1 Detailed Description

A class of normal sprite texts.

5.76.2 Constructor & Destructor Documentation

5.76.2.1 NormalSpriteText() [1/3]

```

mage::NormalSpriteText::NormalSpriteText (
    const string & name,
    SharedPtr< SpriteFont > font,
    SpriteEffect effects = SpriteEffect_None ) [explicit]
  
```

Constructs a normal sprite text.

Precondition

`font.get ()` is not equal to `nullptr`.

Parameters

| | | |
|----|----------------|-------------------------------|
| in | <i>name</i> | The name. |
| in | <i>font</i> | A pointer to the sprite font. |
| in | <i>effects</i> | The sprite effects to apply. |

5.76.2.2 NormalSpriteText() [2/3]

```
mage::NormalSpriteText::NormalSpriteText (
    const NormalSpriteText & sprite_text ) [default]
```

Constructs a normal sprite text from the given normal sprite text.

Parameters

| | | |
|----|--------------------|--|
| in | <i>sprite_text</i> | A reference to the normal sprite text to copy. |
|----|--------------------|--|

5.76.2.3 NormalSpriteText() [3/3]

```
mage::NormalSpriteText::NormalSpriteText (
    NormalSpriteText && sprite_text ) [default]
```

Constructs a normal sprite text by moving the given normal sprite text.

Parameters

| | | |
|----|--------------------|--|
| in | <i>sprite_text</i> | A reference to the normal sprite text to move. |
|----|--------------------|--|

5.76.2.4 ~NormalSpriteText()

```
mage::NormalSpriteText::~NormalSpriteText ( ) [virtual], [default]
```

Destructs this normal sprite text.

5.76.3 Member Function Documentation**5.76.3.1 Clone()**

```
UniquePtr< NormalSpriteText > mage::NormalSpriteText::Clone ( ) const
```

Clones this normal sprite text.

Returns

A pointer to the clone of this normal sprite text.

5.76.3.2 `CloneImplementation()`

```
UniquePtr< SpriteObject > mage::NormalSpriteText::CloneImplementation() const [override], [private], [virtual]
```

Clones this normal sprite text.

Returns

A pointer to the clone of this normal sprite text.

Implements [mage::SpriteText](#).

5.76.3.3 `Draw()`

```
void mage::NormalSpriteText::Draw( SpriteBatch & sprite_batch ) const [override], [virtual]
```

Draws this normal sprite text.

Parameters

| | | |
|----|---------------------|---|
| in | <i>sprite_batch</i> | A reference to the sprite batch used for rendering this normal sprite text. |
|----|---------------------|---|

Implements [mage::SpriteText](#).

5.76.3.4 `operator=()` [1/2]

```
NormalSpriteText& mage::NormalSpriteText::operator=( const NormalSpriteText & sprite_text ) [delete]
```

Copies the given normal sprite text to this normal sprite text.

Parameters

| | | |
|----|--------------------|--|
| in | <i>sprite_text</i> | A reference to the normal sprite text to copy. |
|----|--------------------|--|

Returns

A reference to the copy of the given normal sprite text (i.e. this normal sprite text).

5.76.3.5 `operator=()` [2/2]

```
NormalSpriteText& mage::NormalSpriteText::operator=( NormalSpriteText && sprite_text ) [delete]
```

Moves the given normal sprite text to this normal sprite text.

Parameters

| | | |
|----|--------------------|--|
| in | <i>sprite_text</i> | A reference to the normal sprite text to move. |
|----|--------------------|--|

Returns

A reference to the moved normal sprite text (i.e. this normal sprite text).

5.77 mage::OBJReader< VertexT >::OBJComparatorXMUINT3 Struct Reference**Public Member Functions**

- bool [operator\(\)](#) (const XMUINT3 &a, const XMUINT3 &b) const

5.77.1 Detailed Description

```
template<typename VertexT>
struct mage::OBJReader< VertexT >::OBJComparatorXMUINT3
```

A struct of XMUINT3 comparators for OBJ vertex indices.

5.77.2 Member Function Documentation**5.77.2.1 operator()()**

```
template<typename VertexT >
bool mage::OBJReader< VertexT >::OBJComparatorXMUINT3::operator() (
    const XMUINT3 & a,
    const XMUINT3 & b ) const
```

Compares the two given XMUINT3 vectors against each other.

Parameters

| | | |
|----|----------|-----------------------------------|
| in | <i>a</i> | A reference to the first vector. |
| in | <i>b</i> | A reference to the second vector. |

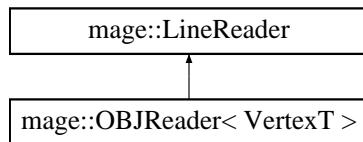
Returns

true if the *a* is smaller than *b*. false otherwise.

5.78 mage::OBJReader< VertexT > Class Template Reference

```
#include <obj_reader.hpp>
```

Inheritance diagram for mage::OBJReader< VertexT >:



Classes

- struct [OBJComparatorXMUINT3](#)

Public Member Functions

- [OBJReader \(ModelOutput< VertexT > &model_output, const MeshDescriptor< VertexT > &mesh_desc\)](#)
- [OBJReader \(const OBJReader &reader\)=delete](#)
- [OBJReader \(OBJReader &&reader\)](#)
- virtual [~OBJReader \(\)](#)
- [OBJReader & operator= \(const OBJReader &reader\)=delete](#)
- [OBJReader & operator= \(OBJReader &&reader\)=delete](#)

Private Member Functions

- virtual void [Preprocess \(\) override](#)
- virtual void [ReadLine \(char *line\) override](#)
- virtual void [Postprocess \(\) override](#)
- void [ReadOBJMaterialLibrary \(\)](#)
- void [ReadOBJMaterialUse \(\)](#)
- void [ReadOBJGroup \(\)](#)
- void [ReadOBJObject \(\)](#)
- void [ReadOBJSmoothingGroup \(\)](#)
- void [ReadOBJVertex \(\)](#)
- void [ReadOBJVertexTexture \(\)](#)
- void [ReadOBJVertexNormal \(\)](#)
- void [ReadOBJFace \(\)](#)
- const Point3 [ReadOBJVertexCoordinates \(\)](#)
- const Normal3 [ReadOBJVertexNormalCoordinates \(\)](#)
- const UV [ReadOBJVertexTextureCoordinates \(\)](#)
- const XMUINT3 [ReadOBJVertexIndices \(\)](#)
- const VertexT [ConstructVertex \(const XMUINT3 &vertex_indices\)](#)

Private Attributes

- vector< [Point3](#) > [m_vertex_coordinates](#)
- vector< [UV](#) > [m_vertex_texture_coordinates](#)
- vector< [Normal3](#) > [m_vertex_normal_coordinates](#)
- map< XMUINT3, uint32_t, [OBJComparatorXMUINT3](#) > [m_mapping](#)
- [ModelOutput< VertexT > & m_model_output](#)
- const [MeshDescriptor< VertexT >](#) [m_mesh_desc](#)

Additional Inherited Members

5.78.1 Detailed Description

```
template<typename VertexT>
class mage::OBJReader< VertexT >
```

A class of OBJ file readers for reading meshes.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

5.78.2 Constructor & Destructor Documentation

5.78.2.1 `OBJReader()` [1/3]

```
template<typename VertexT >
mage::OBJReader< VertexT >::OBJReader (
    ModelOutput< VertexT > & model_output,
    const MeshDescriptor< VertexT > & mesh_desc ) [explicit]
```

Constructs an OBJ reader.

Parameters

| | | |
|----|---------------------|--|
| in | <i>model_output</i> | A reference to a model output for storing the read data from file. |
| in | <i>mesh_desc</i> | A reference to a mesh descriptor. |

5.78.2.2 `OBJReader()` [2/3]

```
template<typename VertexT >
mage::OBJReader< VertexT >::OBJReader (
    const OBJReader< VertexT > & reader ) [delete]
```

Constructs an OBJ reader from the given OBJ reader.

Parameters

| | | |
|----|---------------|--|
| in | <i>reader</i> | A reference to the OBJ reader to copy. |
|----|---------------|--|

5.78.2.3 `OBJReader()` [3/3]

```
template<typename VertexT >
mage::OBJReader< VertexT >::OBJReader (
    OBJReader< VertexT > && reader )
```

Constructs an OBJ reader by moving the given OBJ reader.

Parameters

| | | |
|----|---------------|--|
| in | <i>reader</i> | A reference to the OBJ reader to move. |
|----|---------------|--|

5.78.2.4 ~OBJReader()

```
template<typename VertexT >
virtual mage::OBJReader< VertexT >::~OBJReader ( ) [virtual]
```

Destructs this OBJ reader.

5.78.3 Member Function Documentation

5.78.3.1 ConstructVertex()

```
template<typename VertexT >
const VertexT mage::OBJReader< VertexT >::ConstructVertex (
    const XMUINT3 & vertex_indices ) [private]
```

Constructs or retrieves (if already existing) the vertex matching the given vertex indices.

Parameters

| | | |
|----|-----------------------|------------------------------------|
| in | <i>vertex_indices</i> | A reference to the vertex indices. |
|----|-----------------------|------------------------------------|

Returns

The vertex matching the given vertex indices *vertex_indices*.

5.78.3.2 operator=() [1/2]

```
template<typename VertexT >
OBJReader& mage::OBJReader< VertexT >::operator= (
    const OBJReader< VertexT > & reader ) [delete]
```

Copies the given OBJ reader to this OBJ reader.

Parameters

| | | |
|----|---------------|--------------------------------------|
| in | <i>reader</i> | A reference to a OBJ reader to copy. |
|----|---------------|--------------------------------------|

Returns

A reference to the copy of the given OBJ reader (i.e. this OBJ reader).

5.78.3.3 operator=() [2/2]

```
template<typename VertexT >
OBJReader& mage::OBJReader< VertexT >::operator= (
    OBJReader< VertexT > && reader ) [delete]
```

Moves the given OBJ reader to this OBJ reader.

Parameters

| | | |
|----|---------------|--------------------------------------|
| in | <i>reader</i> | A reference to a OBJ reader to move. |
|----|---------------|--------------------------------------|

Returns

A reference to the moved OBJ reader (i.e. this OBJ reader).

5.78.3.4 Postprocess()

```
template<typename VertexT >
virtual void mage::OBJReader< VertexT >::Postprocess () [override], [private], [virtual]
```

Post-processes after reading the current file of this OBJ reader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to finish post-processing successfully. |
|---------------------------|--|

Reimplemented from [mage::LineReader](#).

5.78.3.5 Preprocess()

```
template<typename VertexT >
virtual void mage::OBJReader< VertexT >::Preprocess () [override], [private], [virtual]
```

Pre-process before reading the current file of this OBJ reader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to finish the pre-processing successfully. |
|---------------------------|---|

Reimplemented from [mage::LineReader](#).

5.78.3.6 ReadLine()

```
template<typename VertexT >
virtual void mage::OBJReader< VertexT >::ReadLine (
    char * line ) [override], [private], [virtual]
```

Reads the given line.

Precondition

line is not equal to `nullptr`.

Parameters

| | | |
|----------------------|-------------------|---|
| <code>in, out</code> | <code>line</code> | A pointer to the null-terminated byte string to read. |
|----------------------|-------------------|---|

Exceptions

| | |
|---------------------------------|--------------------------------|
| <code>FormattedException</code> | Failed to read the given line. |
|---------------------------------|--------------------------------|

Implements [mage::LineReader](#).

5.78.3.7 ReadOBJFace()

```
template<typename VertexT >
void mage::OBJReader< VertexT >::ReadOBJFace ( ) [private]
```

Reads a Face definition.

Exceptions

| | |
|---------------------------------|-----------------------------------|
| <code>FormattedException</code> | Failed to read a Face definition. |
|---------------------------------|-----------------------------------|

5.78.3.8 ReadOBJGroup()

```
template<typename VertexT >
void mage::OBJReader< VertexT >::ReadOBJGroup ( ) [private]
```

Reads a Group definition.

Exceptions

| | |
|---------------------------------|------------------------------------|
| <code>FormattedException</code> | Failed to read a Group definition. |
|---------------------------------|------------------------------------|

5.78.3.9 ReadOBJMaterialLibrary()

```
template<typename VertexT >
void mage::OBJReader< VertexT >::ReadOBJMaterialLibrary ( ) [private]
```

Reads a [Material](#) Library Include definition.

Exceptions

| | |
|---------------------------------|---|
| <code>FormattedException</code> | Failed to read a Material Library Include definition. |
|---------------------------------|---|

5.78.3.10 ReadOBJMaterialUse()

```
template<typename VertexT >
void mage::OBJReader< VertexT >::ReadOBJMaterialUse ( ) [private]
```

Reads a [Material](#) Usage definition and imports the materials corresponding to the mesh.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a Material Usage definition. |
| <i>FormattedException</i> | Failed to import the materials. |

5.78.3.11 ReadOBJObject()

```
template<typename VertexT >
void mage::OBJReader< VertexT >::ReadOBJObject ( ) [private]
```

Reads an Object definition.

Exceptions

| | |
|---------------------------|-------------------------------------|
| <i>FormattedException</i> | Failed to read a Object definition. |
|---------------------------|-------------------------------------|

5.78.3.12 ReadOBJSmoothingGroup()

```
template<typename VertexT >
void mage::OBJReader< VertexT >::ReadOBJSmoothingGroup ( ) [private]
```

Reads a Smoothing Group definition.

Note

A smoothing group is, if present, silently ignored.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Smoothing Group definition. |
|---------------------------|--|

5.78.3.13 ReadOBJVertex()

```
template<typename VertexT >
void mage::OBJReader< VertexT >::ReadOBJVertex ( ) [private]
```

Reads a Vertex Position Coordinates definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Vertex Position Coordinates definition. |
|---------------------------|--|

5.78.3.14 ReadOBJVertexCoordinates()

```
template<typename VertexT >
const Point3 mage::OBJReader< VertexT >::ReadOBJVertexCoordinates ( ) [private]
```

Reads a set of vertex position coordinates.

Returns

The `Point3` represented by the next token of this OBJ reader (modified according to the mesh descriptor of this OBJ reader).

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a <code>Point3</code> . |
|---------------------------|--|

5.78.3.15 ReadOBJVertexIndices()

```
template<typename VertexT >
const XMUINT3 mage::OBJReader< VertexT >::ReadOBJVertexIndices ( ) [private]
```

Reads a set of face indices.

Returns

The face indices represented by the next token of this OBJ reader. A zero indicates the absence of a component.

Exceptions

| | |
|---------------------------|---------------------------------|
| <i>FormattedException</i> | Failed to read a Bool variable. |
|---------------------------|---------------------------------|

5.78.3.16 ReadOBJVertexNormal()

```
template<typename VertexT >
void mage::OBJReader< VertexT >::ReadOBJVertexNormal ( ) [private]
```

Reads a Vertex Normal Coordinates definition.

Precondition

All the vertex normals in the OBJ file are normalized.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Vertex Normal Coordinates definition. |
|---------------------------|--|

5.78.3.17 ReadOBJVertexNormalCoordinates()

```
template<typename VertexT>
const Normal3 mage::OBJReader< VertexT >::ReadOBJVertexNormalCoordinates() [private]
```

Reads a set of vertex normal coordinates.

Precondition

All the vertex normals in the OBJ file are normalized.

Returns

The `Normal3` represented by the next token of this OBJ reader (modified according to the mesh descriptor of this OBJ reader).

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a <code>Normal3</code> . |
|---------------------------|---|

5.78.3.18 ReadOBJVertexTexture()

```
template<typename VertexT>
void mage::OBJReader< VertexT >::ReadOBJVertexTexture() [private]
```

Reads a Vertex `Texture` Coordinates definition.

Note

Only `UV` texture coordinates are supported, The W component of UVW texture coordinates is, if present, silently ignored.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Vertex <code>Texture</code> Coordinates definition. |
|---------------------------|--|

5.78.3.19 ReadOBJVertexTextureCoordinates()

```
template<typename VertexT>
const UV mage::OBJReader< VertexT >::ReadOBJVertexTextureCoordinates() [private]
```

Reads a set of vertex texture coordinates.

Returns

The [UV](#) represented by the next token of this OBJ reader (modified according to the mesh descriptor of this OBJ reader).

Exceptions

| | |
|------------------------------------|---------------------------------------|
| FormattedException | Failed to read a UV . |
|------------------------------------|---------------------------------------|

5.78.4 Member Data Documentation**5.78.4.1 m_mapping**

```
template<typename VertexT >
map< XMUINT3, uint32_t, OBJComparatorXMUINT3 > mage::OBJReader< VertexT >::m_mapping [private]
```

A mapping between vertex position/texture/normal coordinates' indices and the index of a vertex in the vertex buffer ([m_model_output](#)) of this OBJ reader.

5.78.4.2 m_mesh_desc

```
template<typename VertexT >
const MeshDescriptor< VertexT > mage::OBJReader< VertexT >::m_mesh_desc [private]
```

The mesh descriptor for this OBJ reader.

5.78.4.3 m_model_output

```
template<typename VertexT >
ModelOutput< VertexT >& mage::OBJReader< VertexT >::m_model_output [private]
```

A reference to a model output containing the read data of this OBJ reader.

5.78.4.4 m_vertex_coordinates

```
template<typename VertexT >
vector< Point3 > mage::OBJReader< VertexT >::m_vertex_coordinates [private]
```

A vector containing the read vertex position coordinates of this OBJ reader.

5.78.4.5 m_vertex_normal_coordinates

```
template<typename VertexT >
vector< Normal3 > mage::OBJReader< VertexT >::m_vertex_normal_coordinates [private]
```

A vector containing the read normal texture coordinates of this OBJ reader.

5.78.4.6 m_vertex_texture_coordinates

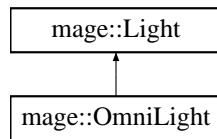
```
template<typename VertexT >
vector< UV > mage::OBJReader< VertexT >::m_vertex_texture_coordinates [private]
```

A vector containing the read vertex texture coordinates of this OBJ reader.

5.79 mage::OmniLight Class Reference

```
#include <omni_light.hpp>
```

Inheritance diagram for mage::OmniLight:



Public Member Functions

- [OmniLight \(const RGBSpectrum &intensity=RGBSpectrum\(1.0f, 1.0f, 1.0f\)\)](#)
- [OmniLight \(const OmniLight &light\)](#)
- [OmniLight \(OmniLight &&light\)](#)
- virtual [~OmniLight \(\)](#)
- [OmniLight & operator= \(const OmniLight &light\)](#)
- [OmniLight & operator= \(OmniLight &&light\)](#)
- [UniquePtr< OmniLight > Clone \(\) const](#)
- float [GetStartDistanceFalloff \(\) const](#)
- [OmniLight & SetStartDistanceFalloff \(float distance_falloff_start\)](#)
- float [GetEndDistanceFalloff \(\) const](#)
- [OmniLight & SetEndDistanceFalloff \(float distance_falloff_end\)](#)
- [OmniLight & SetDistanceFalloff \(float distance_falloff_start, float distance_falloff_end\)](#)

Private Member Functions

- virtual [UniquePtr< Light > CloneImplementation \(\) const override](#)

Private Attributes

- float [m_distance_falloff_start](#)
- float [m_distance_falloff_end](#)

Additional Inherited Members

5.79.1 Detailed Description

A class of omni lights.

5.79.2 Constructor & Destructor Documentation

5.79.2.1 OmniLight() [1/3]

```
mage::OmniLight::OmniLight (
    const RGBSpectrum & intensity = RGBSpectrum(1.0f, 1.0f, 1.0f) ) [explicit]
```

Constructs an omni light.

Parameters

| | | |
|----|------------------|--------------------|
| in | <i>intensity</i> | The RGB intensity. |
|----|------------------|--------------------|

5.79.2.2 OmniLight() [2/3]

```
mage::OmniLight::OmniLight (
    const OmniLight & light ) [default]
```

Constructs an omni light from the given omni light.

Parameters

| | | |
|----|--------------|--|
| in | <i>light</i> | A reference to the omni light to copy. |
|----|--------------|--|

5.79.2.3 OmniLight() [3/3]

```
mage::OmniLight::OmniLight (
    OmniLight && light ) [default]
```

Constructs an omni light by moving the given omni light.

Parameters

| | | |
|----|--------------|--|
| in | <i>light</i> | A reference to the omni light to move. |
|----|--------------|--|

5.79.2.4 ~OmniLight()

```
mage::OmniLight::~OmniLight ( ) [virtual], [default]
```

Destructs this omni light.

5.79.3 Member Function Documentation

5.79.3.1 Clone()

```
UniquePtr< OmniLight > mage::OmniLight::Clone ( ) const
```

Clones this omni light.

Returns

A pointer to the clone of this omni light.

5.79.3.2 CloneImplementation()

```
UniquePtr< Light > mage::OmniLight::CloneImplementation ( ) const [override], [private], [virtual]
```

Clones this omni light.

Returns

A pointer to the clone of this omni light.

Implements [mage::Light](#).

5.79.3.3 GetEndDistanceFalloff()

```
float mage::OmniLight::GetEndDistanceFalloff ( ) const
```

Returns the end of the distance falloff of this omni light.

Returns

The end of the distance falloff of this omni light.

5.79.3.4 GetStartDistanceFalloff()

```
float mage::OmniLight::GetStartDistanceFalloff ( ) const
```

Returns the start of the distance falloff of this omni light.

Returns

The start of the distance falloff of this omni light.

5.79.3.5 operator=() [1/2]

```
OmniLight & mage::OmniLight::operator= (
    const OmniLight & light ) [default]
```

Copies the given omni light to this omni light.

Parameters

| | | |
|----|--------------|--|
| in | <i>light</i> | A reference to the omni light to copy. |
|----|--------------|--|

Returns

A reference to the copy of the given omni light (i.e. this omni light).

5.79.3.6 operator=() [2/2]

```
OmniLight & mage::OmniLight::operator= (
    OmniLight && light ) [default]
```

Moves the given omni light to this omni light.

Parameters

| | | |
|----|--------------|--|
| in | <i>light</i> | A reference to the omni light to move. |
|----|--------------|--|

Returns

A reference to the moved omni light (i.e. this omni light).

5.79.3.7 SetDistanceFalloff()

```
OmniLight& mage::OmniLight::SetDistanceFalloff (
    float distance_falloff_start,
    float distance_falloff_end )
```

Sets the start and end of the distance falloff of this omni light to the given values.

Parameters

| | | |
|----|-------------------------------|------------------------------------|
| in | <i>distance_falloff_start</i> | The start of the distance falloff. |
| in | <i>distance_falloff_end</i> | The end of the distance falloff. |

Returns

A reference to this omni light.

5.79.3.8 SetEndDistanceFalloff()

```
OmniLight& mage::OmniLight::SetEndDistanceFalloff (
    float distance_falloff_end )
```

Sets the end of the distance falloff of this omni light to the given value.

Parameters

| | | |
|----|-----------------------------|----------------------------------|
| in | <i>distance_falloff_end</i> | The end of the distance falloff. |
|----|-----------------------------|----------------------------------|

Returns

A reference to this omni light.

5.79.3.9 SetStartDistanceFalloff()

```
OmniLight& mage::OmniLight::SetStartDistanceFalloff (
    float distance_falloff_start )
```

Sets the start of the distance falloff of this omni light to the given value.

Parameters

| | | |
|----|-------------------------------|------------------------------------|
| in | <i>distance_falloff_start</i> | The start of the distance falloff. |
|----|-------------------------------|------------------------------------|

Returns

A reference to this omni light.

5.79.4 Member Data Documentation**5.79.4.1 m_distance_falloff_end**

```
float mage::OmniLight::m_distance_falloff_end [private]
```

The end of the distance falloff of this omni light.

5.79.4.2 m_distance_falloff_start

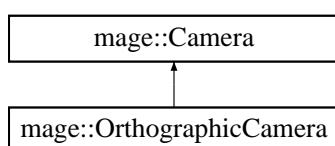
```
float mage::OmniLight::m_distance_falloff_start [private]
```

The start of the distance falloff of this omni light.

5.80 mage::OrthographicCamera Class Reference

```
#include <orthographic_camera.hpp>
```

Inheritance diagram for mage::OrthographicCamera:



Public Member Functions

- `OrthographicCamera` (float width=MAGE_DEFAULT_CAMERA_ORTHOGRAPHIC_WIDTH, float height=MAGE_DEFAULT_CAMERA_ORTHOGRAPHIC_HEIGHT, float near_z=MAGE_DEFAULT_CAMERA_NEAR_Z, float far_z=MAGE_DEFAULT_CAMERA_FAR_Z)
- `OrthographicCamera` (const `OrthographicCamera` &camera)
- `OrthographicCamera` (`OrthographicCamera` &&camera)
- virtual ~`OrthographicCamera` ()
- `OrthographicCamera` & `operator=` (const `OrthographicCamera` &camera)
- `OrthographicCamera` & `operator=` (`OrthographicCamera` &&camera)
- `UniquePtr< OrthographicCamera > Clone` () const
- float `GetWidth` () const
- `OrthographicCamera` & `SetWidth` (float width)
- float `GetHeight` () const
- `OrthographicCamera` & `SetHeight` (float height)
- `OrthographicCamera` & `SetWidthAndHeight` (float width, float height)
- void `SetViewToProjectionMatrix` (float width=MAGE_DEFAULT_CAMERA_ORTHOGRAPHIC_WIDTH, float height=MAGE_DEFAULT_CAMERA_ORTHOGRAPHIC_HEIGHT, float near_z=MAGE_DEFAULT_CAMERA_NEAR_Z, float far_z=MAGE_DEFAULT_CAMERA_FAR_Z)
- virtual XMATRIX `GetViewToProjectionMatrix` () const override

Private Member Functions

- virtual `UniquePtr< Camera > ClonelImplementation` () const override

Private Attributes

- float `m_width`
- float `m_height`

Additional Inherited Members

5.80.1 Detailed Description

A class of orthographic cameras.

5.80.2 Constructor & Destructor Documentation

5.80.2.1 OrthographicCamera() [1/3]

```
mage::OrthographicCamera::OrthographicCamera (
    float width = MAGE_DEFAULT_CAMERA_ORTHOGRAPHIC_WIDTH,
    float height = MAGE_DEFAULT_CAMERA_ORTHOGRAPHIC_HEIGHT,
    float near_z = MAGE_DEFAULT_CAMERA_NEAR_Z,
    float far_z = MAGE_DEFAULT_CAMERA_FAR_Z ) [explicit]
```

Constructs an orthographic camera.

Parameters

| | | |
|----|---------------|--|
| in | <i>width</i> | The width of the camera projection plane in camera space. |
| in | <i>height</i> | The height of the camera projection plane in camera space. |
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
| in | <i>far_z</i> | The position of the far z-plane in camera space. |

5.80.2.2 OrthographicCamera() [2/3]

```
mage::OrthographicCamera::OrthographicCamera (
    const OrthographicCamera & camera ) [default]
```

Constructs an orthographic camera from the given orthographic camera.

Parameters

| | | |
|----|---------------|---|
| in | <i>camera</i> | A reference to the orthographic camera to copy. |
|----|---------------|---|

5.80.2.3 OrthographicCamera() [3/3]

```
mage::OrthographicCamera::OrthographicCamera (
    OrthographicCamera && camera ) [default]
```

Constructs an orthographic camera by moving the given orthographic camera.

Parameters

| | | |
|----|---------------|---|
| in | <i>camera</i> | A reference to the orthographic camera to move. |
|----|---------------|---|

5.80.2.4 ~OrthographicCamera()

```
mage::OrthographicCamera::~OrthographicCamera ( ) [virtual], [default]
```

Destructs this orthographic camera.

5.80.3 Member Function Documentation**5.80.3.1 Clone()**

```
UniquePtr< OrthographicCamera > mage::OrthographicCamera::Clone ( ) const
```

Clones this orthographic camera.

Returns

A pointer to the clone of this orthographic camera.

5.80.3.2 `CloneImplementation()`

```
UniquePtr< Camera > mage::OrthographicCamera::CloneImplementation() const [override], [private], [virtual]
```

Clones this orthographic camera.

Returns

A pointer to the clone of this orthographic camera.

Implements [mage::Camera](#).

5.80.3.3 `GetHeight()`

```
float mage::OrthographicCamera::GetHeight() const
```

Returns the height of the camera projection plane of this orthographic camera in camera space.

Returns

The height of the camera projection plane of this orthographic camera in camera space.

5.80.3.4 `GetViewToProjectionMatrix()`

```
virtual XMATRIX mage::OrthographicCamera::GetViewToProjectionMatrix() const [override], [virtual]
```

Returns the view-to-projection matrix of this orthographic camera.

Returns

The view-to-projection matrix of this orthographic camera.

Implements [mage::Camera](#).

5.80.3.5 `GetWidth()`

```
float mage::OrthographicCamera::GetWidth() const
```

Returns the width of the camera projection plane of this orthographic camera in camera space.

Returns

The width of the camera projection plane of this orthographic camera in camera space.

5.80.3.6 `operator=()` [1/2]

```
OrthographicCamera & mage::OrthographicCamera::operator= (const OrthographicCamera & camera) [default]
```

Copies the given orthographic camera to this orthographic camera.

Parameters

| | | |
|----|---------------|---|
| in | <i>camera</i> | A reference to the orthographic camera to copy. |
|----|---------------|---|

Returns

A reference to the copy of the given orthographic camera (i.e. this orthographic camera).

5.80.3.7 operator=() [2/2]

```
OrthographicCamera & mage::OrthographicCamera::operator= (
    OrthographicCamera && camera ) [default]
```

Moves the given orthographic camera to this orthographic camera.

Parameters

| | | |
|----|---------------|---|
| in | <i>camera</i> | A reference to the orthographic camera to move. |
|----|---------------|---|

Returns

A reference to the moved orthographic camera (i.e. this orthographic camera).

5.80.3.8 SetHeight()

```
OrthographicCamera& mage::OrthographicCamera::SetHeight (
    float height )
```

Sets the height of the camera projection plane of this orthographic camera to the given value.

Parameters

| | | |
|----|---------------|--|
| in | <i>height</i> | The height of the camera projection plane in camera space. |
|----|---------------|--|

Returns

A reference to this orthographic camera.

5.80.3.9 SetViewToProjectionMatrix()

```
void mage::OrthographicCamera::SetViewToProjectionMatrix (
    float width = MAGE_DEFAULT_CAMERA_ORTHOGRAPHIC_WIDTH,
    float height = MAGE_DEFAULT_CAMERA_ORTHOGRAPHIC_HEIGHT,
    float near_z = MAGE_DEFAULT_CAMERA_NEAR_Z,
    float far_z = MAGE_DEFAULT_CAMERA_FAR_Z )
```

Sets the view-to-projection matrix of this orthographic camera.

Parameters

| | | |
|----|---------------|--|
| in | <i>width</i> | The width of the camera projection plane in camera space. |
| in | <i>height</i> | The height of the camera projection plane in camera space. |
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
| in | <i>far_z</i> | The position of the far z-plane in camera space. |

5.80.3.10 SetWidth()

```
OrthographicCamera& mage::OrthographicCamera::SetWidth (
    float width )
```

Sets the width of the camera projection plane of this orthographic camera to the given value.

Parameters

| | | |
|----|--------------|---|
| in | <i>width</i> | The width of the camera projection plane in camera space. |
|----|--------------|---|

Returns

A reference to this orthographic camera.

5.80.3.11 SetWidthAndHeight()

```
OrthographicCamera& mage::OrthographicCamera::SetWidthAndHeight (
    float width,
    float height )
```

Sets the width and height of the camera projection plane of this orthographic camera to the given values.

Parameters

| | | |
|----|---------------|--|
| in | <i>width</i> | The width of the camera projection plane in camera space. |
| in | <i>height</i> | The height of the camera projection plane in camera space. |

Returns

A reference to this orthographic camera.

5.80.4 Member Data Documentation**5.80.4.1 m_height**

```
float mage::OrthographicCamera::m_height [private]
```

The height of the camera projection plane of this orthographic camera in camera space.

5.80.4.2 m_width

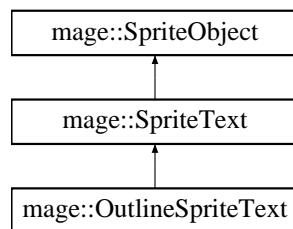
```
float mage::OrthographicCamera::m_width [private]
```

The width of the camera projection plane of this orthographic camera in camera space.

5.81 mage::OutlineSpriteText Class Reference

```
#include <outline_sprite_text.hpp>
```

Inheritance diagram for mage::OutlineSpriteText:



Public Member Functions

- `OutlineSpriteText (const string &name, SharedPtr< SpriteFont > font, const Color &border_color, SpriteEffect effects=SpriteEffect_None)`
- `OutlineSpriteText (const string &name, SharedPtr< SpriteFont > font, const XMVECTOR &border_color=Colors::Black, SpriteEffect effects=SpriteEffect_None)`
- `OutlineSpriteText (const OutlineSpriteText &sprite_text)`
- `OutlineSpriteText (OutlineSpriteText &&sprite_text)`
- `virtual ~OutlineSpriteText ()`
- `OutlineSpriteText & operator= (const OutlineSpriteText &sprite_text)=delete`
- `OutlineSpriteText & operator= (OutlineSpriteText &&sprite_text)=delete`
- `UniquePtr< OutlineSpriteText > Clone () const`
- `virtual void Draw (SpriteBatch &sprite_batch) const override`
- `const Color GetBorderColor () const`
- `void SetBorderColor (const Color &color)`
- `void SetBorderColor (const XMVECTOR &color)`

Private Member Functions

- `virtual UniquePtr< SpriteObject > CloneImplementation () const override`
- `const XMVECTOR GetBorderColorVector () const`

Private Attributes

- `Color m_border_color`

Additional Inherited Members

5.81.1 Detailed Description

A class of outline sprite texts.

5.81.2 Constructor & Destructor Documentation

5.81.2.1 OutlineSpriteText() [1/4]

```
mage::OutlineSpriteText::OutlineSpriteText (
    const string & name,
    SharedPtr< SpriteFont > font,
    const Color & border_color,
    SpriteEffect effects = SpriteEffect_None ) [explicit]
```

Constructs a outline sprite text.

Precondition

`font.get()` is not equal to `nullptr`.

Parameters

| | | |
|----|---------------------------|----------------------------------|
| in | <code>name</code> | The name. |
| in | <code>font</code> | A pointer to the sprite font. |
| in | <code>border_color</code> | A reference to the border color. |
| in | <code>effects</code> | The sprite effects to apply. |

5.81.2.2 OutlineSpriteText() [2/4]

```
mage::OutlineSpriteText::OutlineSpriteText (
    const string & name,
    SharedPtr< SpriteFont > font,
    const XMVECTOR & border_color = Colors::Black,
    SpriteEffect effects = SpriteEffect_None ) [explicit]
```

Constructs a outline sprite text.

Precondition

`font.get()` is not equal to `nullptr`.

Parameters

| | | |
|----|---------------------------|----------------------------------|
| in | <code>name</code> | The name. |
| in | <code>font</code> | A pointer to the sprite font. |
| in | <code>border_color</code> | A reference to the border color. |
| in | <code>effects</code> | The sprite effects to apply. |

5.81.2.3 OutlineSpriteText() [3/4]

```
mage::OutlineSpriteText::OutlineSpriteText (
    const OutlineSpriteText & sprite_text ) [default]
```

Constructs a outline sprite text from the given outline sprite text.

Parameters

| | | |
|----|--------------------|---|
| in | <i>sprite_text</i> | A reference to the outline sprite text to copy. |
|----|--------------------|---|

5.81.2.4 OutlineSpriteText() [4/4]

```
mage::OutlineSpriteText::OutlineSpriteText (
    OutlineSpriteText && sprite_text ) [default]
```

Constructs a outline sprite text by moving the given outline sprite text.

Parameters

| | | |
|----|--------------------|---|
| in | <i>sprite_text</i> | A reference to the outline sprite text to move. |
|----|--------------------|---|

5.81.2.5 ~OutlineSpriteText()

```
mage::OutlineSpriteText::~OutlineSpriteText ( ) [virtual], [default]
```

Destructs this outline sprite text.

5.81.3 Member Function Documentation

5.81.3.1 Clone()

```
UniquePtr< OutlineSpriteText > mage::OutlineSpriteText::Clone ( ) const
```

Clones this outline sprite text.

Returns

A pointer to the clone of this outline sprite text.

5.81.3.2 ClonImplementation()

```
UniquePtr< SpriteObject > mage::OutlineSpriteText::CloneImplementation ( ) const [override], [private], [virtual]
```

Clones this outline sprite text.

Returns

A pointer to the clone of this outline sprite text.

Implements [mage::SpriteText](#).

5.81.3.3 Draw()

```
void mage::OutlineSpriteText::Draw (
    SpriteBatch & sprite_batch ) const [override], [virtual]
```

Draws this outline sprite text.

Parameters

| | | |
|----|---------------------|--|
| in | <i>sprite_batch</i> | A reference to the sprite batch used for rendering this outline sprite text. |
|----|---------------------|--|

Implements [mage::SpriteText](#).

5.81.3.4 GetBorderColor()

```
const Color mage::OutlineSpriteText::GetBorderColor ( ) const
```

Returns the border color of this outline sprite text.

Returns

The border color of this outline sprite text.

5.81.3.5 GetBorderColorVector()

```
const XMVECTOR mage::OutlineSpriteText::GetBorderColorVector ( ) const [private]
```

Returns the border color of this outline sprite text as XMVECTOR.

Returns

The border color of this outline sprite text as XMVECTOR.

5.81.3.6 operator=() [1/2]

```
OutlineSpriteText& mage::OutlineSpriteText::operator=
    const OutlineSpriteText & sprite_text ) [delete]
```

Copies the given outline sprite text to this outline sprite text.

Parameters

| | | |
|----|--------------------|---|
| in | <i>sprite_text</i> | A reference to the outline sprite text to copy. |
|----|--------------------|---|

Returns

A reference to the copy of the given outline sprite text (i.e. this outline sprite text).

5.81.3.7 operator=() [2/2]

```
OutlineSpriteText& mage::OutlineSpriteText::operator= (
    OutlineSpriteText && sprite_text ) [delete]
```

Moves the given outline sprite text to this outline sprite text.

Parameters

| | | |
|----|--------------------|---|
| in | <i>sprite_text</i> | A reference to the outline sprite text to move. |
|----|--------------------|---|

Returns

A reference to the moved outline sprite text (i.e. this outline sprite text).

5.81.3.8 SetBorderColor() [1/2]

```
void mage::OutlineSpriteText::SetBorderColor (
    const Color & color )
```

Sets the border color of this outline sprite text to the given color.

Parameters

| | | |
|----|--------------|----------------------------------|
| in | <i>color</i> | A reference to the border color. |
|----|--------------|----------------------------------|

5.81.3.9 SetBorderColor() [2/2]

```
void mage::OutlineSpriteText::SetBorderColor (
    const XMVECTOR & color )
```

Sets the border color of this outline sprite text to the given color.

Parameters

| | | |
|----|--------------|----------------------------------|
| in | <i>color</i> | A reference to the border color. |
|----|--------------|----------------------------------|

5.81.4 Member Data Documentation**5.81.4.1 m_border_color**

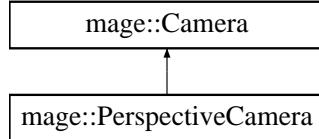
```
Color mage::OutlineSpriteText::m_border_color [private]
```

The border color of this outline sprite text.

5.82 mage::PerspectiveCamera Class Reference

```
#include <perspective_camera.hpp>
```

Inheritance diagram for mage::PerspectiveCamera:



Public Member Functions

- [PerspectiveCamera](#) (float aspect_ratio, float fov_y=MAGE_DEFAULT_CAMERA_PERSPECTIVE_FOV_Y, float near_z=MAGE_DEFAULT_CAMERA_NEAR_Z, float far_z=MAGE_DEFAULT_CAMERA_FAR_Z)
- [PerspectiveCamera](#) (float width, float height, float fov_y=MAGE_DEFAULT_CAMERA_PERSPECTIVE_FOV_Y, float near_z=MAGE_DEFAULT_CAMERA_NEAR_Z, float far_z=MAGE_DEFAULT_CAMERA_FAR_Z)
- [PerspectiveCamera](#) (const [PerspectiveCamera](#) &camera)
- [PerspectiveCamera](#) ([PerspectiveCamera](#) &&camera)
- virtual ~[PerspectiveCamera](#) ()
- [PerspectiveCamera](#) & [operator=](#) (const [PerspectiveCamera](#) &camera)
- [PerspectiveCamera](#) & [operator=](#) ([PerspectiveCamera](#) &&camera)
- [UniquePtr< PerspectiveCamera > Clone](#) () const
- float [GetFOVY](#) () const
- [PerspectiveCamera](#) & [SetFOVY](#) (float fov_y)
- float [GetAspectRatio](#) () const
- [PerspectiveCamera](#) & [SetAspectRatio](#) (float aspect_ratio)
- [PerspectiveCamera](#) & [SetAspectRatio](#) (float width, float height)
- void [SetViewToProjectionMatrix](#) (float aspect_ratio, float fov_y=MAGE_DEFAULT_CAMERA_PERSPECTIVE_FOV_Y, float near_z=MAGE_DEFAULT_CAMERA_NEAR_Z, float far_z=MAGE_DEFAULT_CAMERA_FAR_Z)
- void [SetViewToProjectionMatrix](#) (float width, float height, float fov_y=MAGE_DEFAULT_CAMERA_PERSPECTIVE_FOV_Y, float near_z=MAGE_DEFAULT_CAMERA_NEAR_Z, float far_z=MAGE_DEFAULT_CAMERA_FAR_Z)
- virtual XMATRIX [GetViewToProjectionMatrix](#) () const override

Private Member Functions

- virtual [UniquePtr< Camera > CloneImplementation](#) () const override

Private Attributes

- float [m_aspect_ratio](#)
- float [m_fov_y](#)

Additional Inherited Members

5.82.1 Detailed Description

A class of perspective cameras.

5.82.2 Constructor & Destructor Documentation

5.82.2.1 PerspectiveCamera() [1/4]

```
mage::PerspectiveCamera::PerspectiveCamera (
    float aspect_ratio,
    float fov_y = MAGE_DEFAULT_CAMERA_PERSPECTIVE_FOV_Y,
    float near_z = MAGE_DEFAULT_CAMERA_NEAR_Z,
    float far_z = MAGE_DEFAULT_CAMERA_FAR_Z ) [explicit]
```

Constructs a perspective camera.

Parameters

| | | |
|----|---------------------|---|
| in | <i>aspect_ratio</i> | The aspect ratio. |
| in | <i>fov_y</i> | The vertical field-of-view. |
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
| in | <i>far_z</i> | The position of the far z-plane in camera space. |

5.82.2.2 PerspectiveCamera() [2/4]

```
mage::PerspectiveCamera::PerspectiveCamera (
    float width,
    float height,
    float fov_y = MAGE_DEFAULT_CAMERA_PERSPECTIVE_FOV_Y,
    float near_z = MAGE_DEFAULT_CAMERA_NEAR_Z,
    float far_z = MAGE_DEFAULT_CAMERA_FAR_Z ) [explicit]
```

Constructs a perspective camera.

Parameters

| | | |
|----|---------------|---|
| in | <i>width</i> | The width. |
| in | <i>height</i> | The height. |
| in | <i>fov_y</i> | The vertical field-of-view. |
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
| in | <i>far_z</i> | The position of the far z-plane in camera space. |

5.82.2.3 PerspectiveCamera() [3/4]

```
mage::PerspectiveCamera::PerspectiveCamera (
    const PerspectiveCamera & camera ) [default]
```

Constructs a perspective camera from the given perspective camera.

Parameters

| | | |
|----|---------------|--|
| in | <i>camera</i> | A reference to the perspective camera to copy. |
|----|---------------|--|

5.82.2.4 PerspectiveCamera() [4/4]

```
mage::PerspectiveCamera::PerspectiveCamera (
    PerspectiveCamera && camera ) [default]
```

Constructs a perspective camera by moving the given perspective camera.

Parameters

| | | |
|----|--------|--|
| in | camera | A reference to the perspective camera to move. |
|----|--------|--|

5.82.2.5 ~PerspectiveCamera()

```
mage::PerspectiveCamera::~PerspectiveCamera ( ) [virtual], [default]
```

Destructs this perspective camera.

5.82.3 Member Function Documentation

5.82.3.1 Clone()

```
UniquePtr< PerspectiveCamera > mage::PerspectiveCamera::Clone ( ) const
```

Clones this perspective camera.

Returns

A pointer to the clone of this perspective camera.

5.82.3.2 CloneImplementation()

```
UniquePtr< Camera > mage::PerspectiveCamera::CloneImplementation ( ) const [override], [private], [virtual]
```

Clones this perspective camera.

Returns

A pointer to the clone of this perspective camera.

Implements [mage::Camera](#).

5.82.3.3 GetAspectRatio()

```
float mage::PerspectiveCamera::GetAspectRatio ( ) const
```

Returns the aspect ratio of this perspective camera.

Returns

The aspect ratio of this perspective camera.

5.82.3.4 GetFOVY()

```
float mage::PerspectiveCamera::GetFOVY ( ) const
```

Returns the vertical field-of-view of this perspective camera.

Returns

The vertical field-of-view of this perspective camera.

5.82.3.5 GetViewToProjectionMatrix()

```
virtual XMMATRIX mage::PerspectiveCamera::GetViewToProjectionMatrix ( ) const [override],  
[virtual]
```

Returns the view-to-projection matrix of this perspective camera.

Returns

The view-to-projection matrix of this perspective camera.

Implements [mage::Camera](#).

5.82.3.6 operator=() [1/2]

```
PerspectiveCamera & mage::PerspectiveCamera::operator= (   
    const PerspectiveCamera & camera ) [default]
```

Copies the given perspective camera to this perspective camera.

Parameters

| | | |
|----|--------|--|
| in | camera | A reference to the perspective camera to copy. |
|----|--------|--|

Returns

A reference to the copy of the given perspective camera (i.e. this perspective camera).

5.82.3.7 operator=() [2/2]

```
PerspectiveCamera & mage::PerspectiveCamera::operator= (   
    PerspectiveCamera && camera ) [default]
```

Moves the given perspective camera to this perspective camera.

Parameters

| | | |
|----|--------|--|
| in | camera | A reference to the perspective camera to move. |
|----|--------|--|

Returns

A reference to the moved perspective camera (i.e. this perspective camera).

5.82.3.8 SetAspectRatio() [1/2]

```
PerspectiveCamera& mage::PerspectiveCamera::SetAspectRatio (
    float aspect_ratio )
```

Sets the aspect ratio of this perspective camera to the given value.

Parameters

| | | |
|----|---------------------|-------------------|
| in | <i>aspect_ratio</i> | The aspect ratio. |
|----|---------------------|-------------------|

Returns

A reference to this perspective camera.

5.82.3.9 SetAspectRatio() [2/2]

```
PerspectiveCamera& mage::PerspectiveCamera::SetAspectRatio (
    float width,
    float height )
```

Sets the aspect ratio of this perspective camera.

Parameters

| | | |
|----|---------------|-------------|
| in | <i>width</i> | The width. |
| in | <i>height</i> | The height. |

Returns

A reference to this perspective camera.

5.82.3.10 SetFOVY()

```
PerspectiveCamera& mage::PerspectiveCamera::SetFOVY (
    float fov_y )
```

Sets the vertical field-of-view of this perspective camera to the given value.

Parameters

| | | |
|----|--------------|-----------------------------|
| in | <i>fov_y</i> | The vertical field-of-view. |
|----|--------------|-----------------------------|

Returns

A reference to this perspective camera.

5.82.3.11 SetViewToProjectionMatrix() [1/2]

```
void mage::PerspectiveCamera::SetViewToProjectionMatrix (
    float aspect_ratio,
    float fov_y = MAGE_DEFAULT_CAMERA_PERSPECTIVE_FOV_Y,
    float near_z = MAGE_DEFAULT_CAMERA_NEAR_Z,
    float far_z = MAGE_DEFAULT_CAMERA_FAR_Z )
```

Sets the view-to-projection matrix of this perspective camera.

Parameters

| | | |
|----|---------------------|---|
| in | <i>aspect_ratio</i> | The aspect ratio. |
| in | <i>fov_y</i> | The vertical field-of-view. |
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
| in | <i>far_z</i> | The position of the far z-plane in camera space. |

5.82.3.12 SetViewToProjectionMatrix() [2/2]

```
void mage::PerspectiveCamera::SetViewToProjectionMatrix (
    float width,
    float height,
    float fov_y = MAGE_DEFAULT_CAMERA_PERSPECTIVE_FOV_Y,
    float near_z = MAGE_DEFAULT_CAMERA_NEAR_Z,
    float far_z = MAGE_DEFAULT_CAMERA_FAR_Z )
```

Sets the view-to-projection matrix of this perspective camera.

Parameters

| | | |
|----|---------------|---|
| in | <i>width</i> | The width. |
| in | <i>height</i> | The height. |
| in | <i>fov_y</i> | The vertical field-of-view. |
| in | <i>near_z</i> | The position of the near z-plane in camera space. |
| in | <i>far_z</i> | The position of the far z-plane in camera space. |

5.82.4 Member Data Documentation**5.82.4.1 m_aspect_ratio**

```
float mage::PerspectiveCamera::m_aspect_ratio [private]
```

The aspect ratio of this perspective camera.

5.82.4.2 m_fov_y

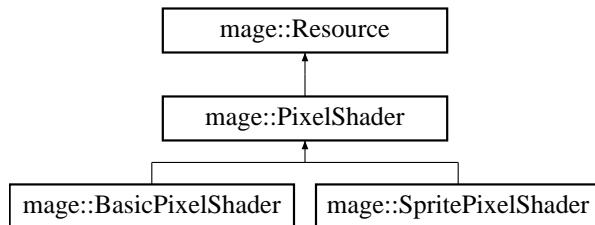
```
float mage::PerspectiveCamera::m_fov_y [private]
```

The vertical field-of-view of this perspective camera.

5.83 mage::PixelShader Class Reference

```
#include <shader.hpp>
```

Inheritance diagram for mage::PixelShader:



Public Member Functions

- [PixelShader](#) (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const wstring &fname)
- [PixelShader](#) (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const [CompiledPixelShader](#) &compiled_pixel_shader)
- [PixelShader](#) (const [PixelShader](#) &pixel_shader)=delete
- [PixelShader](#) ([PixelShader](#) &&pixel_shader)
- virtual ~[PixelShader](#) ()
- [PixelShader](#) & operator= (const [PixelShader](#) &pixel_shader)=delete
- [PixelShader](#) & operator= ([PixelShader](#) &&pixel_shader)=delete
- virtual void [PrepareShading](#) (ID3D11ShaderResourceView *texture) const
- virtual void [PrepareShading](#) (const [Material](#) &material, const [Lighting](#) &lighting) const

Protected Attributes

- ID3D11Device2 *const [m_device](#)
- ID3D11DeviceContext2 *const [m_device_context](#)
- ComPtr< ID3D11PixelShader > [m_pixel_shader](#)

Private Member Functions

- void [SetupShader](#) ()
- void [SetupShader](#) (const [CompiledPixelShader](#) &compiled_pixel_shader)

5.83.1 Detailed Description

A class of pixel shaders.

5.83.2 Constructor & Destructor Documentation

5.83.2.1 PixelShader() [1/4]

```
mage::PixelShader::PixelShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const wstring & fname ) [explicit]
```

Constructs a pixel shader.

Precondition

device is not equal to nullptr.
device_context is not equal to nullptr.

Parameters

| | | |
|----|-----------------------|----------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>fname</i> | A reference to the filename. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to initialize this pixel shader. |
|---------------------------|---|

5.83.2.2 PixelShader() [2/4]

```
mage::PixelShader::PixelShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const CompiledPixelShader & compiled_pixel_shader ) [explicit]
```

Constructs a pixel shader.

Precondition

device is not equal to nullptr.
device_context is not equal to nullptr.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>compiled_pixel_shader</i> | A reference to the compiled pixel shader. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to initialize this pixel shader. |
|---------------------------|---|

5.83.2.3 PixelShader() [3/4]

```
mage::PixelShader::PixelShader (
    const PixelShader & pixel_shader ) [delete]
```

Constructs a pixel shader from the given pixel shader.

Parameters

| | | |
|----|---------------------|--|
| in | <i>pixel_shader</i> | A reference to the pixel shader to copy. |
|----|---------------------|--|

5.83.2.4 PixelShader() [4/4]

```
mage::PixelShader::PixelShader (
    PixelShader && pixel_shader ) [default]
```

Constructs a pixel shader by moving the given pixel shader.

Parameters

| | | |
|----|---------------------|--|
| in | <i>pixel_shader</i> | A reference to the pixel shader to move. |
|----|---------------------|--|

5.83.2.5 ~PixelShader()

```
mage::PixelShader::~PixelShader ( ) [virtual], [default]
```

Destructs this pixel shader.

5.83.3 Member Function Documentation

5.83.3.1 operator=() [1/2]

```
PixelShader& mage::PixelShader::operator= (
    const PixelShader & pixel_shader ) [delete]
```

Copies the given pixel shader to this pixel shader.

Parameters

| | | |
|----|---------------------|--|
| in | <i>pixel_shader</i> | A reference to the pixel shader to copy. |
|----|---------------------|--|

Returns

A reference to the copy of the given pixel shader (i.e. this pixel shader).

5.83.3.2 operator=() [2/2]

```
PixelShader& mage::PixelShader::operator= (
    PixelShader && pixel_shader ) [delete]
```

Moves the given pixel shader to this pixel shader.

Parameters

| | | |
|----|---------------------|--|
| in | <i>pixel_shader</i> | A reference to the pixel shader to move. |
|----|---------------------|--|

Returns

A reference to the moved pixel shader (i.e. this pixel shader).

5.83.3.3 PrepareShading() [1/2]

```
void mage::PixelShader::PrepareShading (
    ID3D11ShaderResourceView * texture ) const [virtual]
```

Prepares this pixel shader for shading.

Precondition

texture is not equal to `nullptr`.

Parameters

| | | |
|----|----------------|--|
| in | <i>texture</i> | A pointer to the texture shader resource view. |
|----|----------------|--|

Reimplemented in [mage::SpritePixelShader](#).

5.83.3.4 PrepareShading() [2/2]

```
void mage::PixelShader::PrepareShading (
    const Material & material,
    const Lighting & lighting ) const [virtual]
```

Prepares this pixel shader for shading.

Parameters

| | | |
|----|-----------------|-------------------------------------|
| in | <i>material</i> | A reference to the material. |
| in | <i>lighting</i> | A reference to the lighting buffer. |

Reimplemented in [mage::BasicPixelShader](#).

5.83.3.5 SetupShader() [1/2]

```
void mage::PixelShader::SetupShader ( ) [private]
```

Sets up this pixel shader (from compiled shader output).

Exceptions

| | |
|---------------------------|------------------------------------|
| <i>FormattedException</i> | Failed to setup this pixel shader. |
|---------------------------|------------------------------------|

5.83.3.6 SetupShader() [2/2]

```
void mage::PixelShader::SetupShader (
    const CompiledPixelShader & compiled_pixel_shader ) [private]
```

Sets up this pixel shader.

Parameters

| | | |
|-----------|------------------------------|---|
| <i>in</i> | <i>compiled_pixel_shader</i> | A reference to the compiled pixel shader. |
|-----------|------------------------------|---|

Exceptions

| | |
|---------------------------|------------------------------------|
| <i>FormattedException</i> | Failed to setup this pixel shader. |
|---------------------------|------------------------------------|

5.83.4 Member Data Documentation

5.83.4.1 m_device

```
ID3D11Device2* const mage::PixelShader::m_device [protected]
```

A pointer to the device of this pixel shader.

5.83.4.2 m_device_context

```
ID3D11DeviceContext2* const mage::PixelShader::m_device_context [protected]
```

A pointer to the device context of this pixel shader.

5.83.4.3 m_pixel_shader

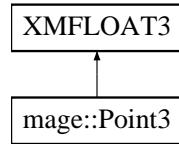
```
ComPtr< ID3D11PixelShader > mage::PixelShader::m_pixel_shader [protected]
```

A pointer to the pixel shader of this pixel shader.

5.84 mage::Point3 Struct Reference

```
#include <math.hpp>
```

Inheritance diagram for mage::Point3:



Public Member Functions

- [Point3 \(\)](#)
- [Point3 \(float x, float y, float z\)](#)
- [Point3 \(const Point3 &point\)](#)
- [Point3 \(Point3 &&point\)](#)
- [Point3 \(const XMFLOAT3 &v\)](#)
- [Point3 \(XMFLOAT3 &&v\)](#)
- [~Point3 \(\)=default](#)
- [Point3 & operator= \(const Point3 &point\)](#)
- [Point3 & operator= \(Point3 &&point\)](#)

5.84.1 Detailed Description

A struct of points in 3D space.

5.84.2 Constructor & Destructor Documentation

5.84.2.1 Point3() [1/6]

```
mage::Point3::Point3 ( )
```

Constructs a point.

5.84.2.2 Point3() [2/6]

```
mage::Point3::Point3 (
    float x,
    float y,
    float z )
```

Constructs a point from the given coordinates.

Parameters

| | | |
|----|---|-------------------|
| in | x | The x-coordinate. |
| in | y | The y-coordinate. |
| in | z | The z-coordinate. |

5.84.2.3 Point3() [3/6]

```
mage::Point3::Point3 (
    const Point3 & point )
```

Constructs a point from the given point.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | point | A reference to the point to copy. |
|----|-------|-----------------------------------|

5.84.2.4 Point3() [4/6]

```
mage::Point3::Point3 (
    Point3 && point )
```

Constructs a point by moving the given point.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | point | A reference to the point to move. |
|----|-------|-----------------------------------|

5.84.2.5 Point3() [5/6]

```
mage::Point3::Point3 (
    const XMFLOAT3 & v ) [explicit]
```

Constructs a point from the given vector.

Parameters

| | | |
|----|---|------------------------------------|
| in | v | A reference to the vector to copy. |
|----|---|------------------------------------|

5.84.2.6 Point3() [6/6]

```
mage::Point3::Point3 (
    XMFLOAT3 && v ) [explicit]
```

Constructs a point by moving the given vector.

Parameters

| | | |
|----|---|------------------------------------|
| in | v | A reference to the vector to move. |
|----|---|------------------------------------|

5.84.2.7 ~Point3()

```
mage::Point3::~Point3 ( ) [default]
```

Constructs a point.

5.84.3 Member Function Documentation

5.84.3.1 operator=() [1/2]

```
Point3& mage::Point3::operator= (
    const Point3 & point )
```

Copies the given point to this point.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | point | A reference to the point to copy. |
|----|-------|-----------------------------------|

Returns

A reference to the copy of the given point (i.e. this point).

5.84.3.2 operator=() [2/2]

```
Point3& mage::Point3::operator= (
    Point3 && point )
```

Moves the given point to this point.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | point | A reference to the point to move. |
|----|-------|-----------------------------------|

Returns

A reference to the moved point (i.e. this point).

5.85 mage::ProgressReporter Class Reference

```
#include <progress_reporter.hpp>
```

Public Member Functions

- [ProgressReporter](#) (const string &title, uint32_t nb_work, char plus_char='+', uint32_t bar_length=0)

- `ProgressReporter (const ProgressReporter &progress_reporter)=delete`
- `ProgressReporter (ProgressReporter &&progress_reporter)`
- `~ProgressReporter ()`
- `ProgressReporter & operator= (const ProgressReporter &progress_reporter)=delete`
- `ProgressReporter & operator= (ProgressReporter &&progress_reporter)=delete`
- `void Update (uint32_t nb_work=1)`
- `void Done ()`

Private Member Functions

- `void Initialize (const string &title, uint32_t bar_length=0)`

Private Attributes

- `const uint32_t m_nb_work_total`
- `uint32_t m_nb_work_done`
- `uint32_t m_nb_plusses_total`
- `uint32_t m_nb_plusses_printed`
- `const char m_plus_char`
- `FILE * m_fout`
- `UniquePtr<char []> m_buffer`
- `char * m_current_pos`
- `UniquePtr<Timer> m_timer`
- `Mutex m_mutex`

5.85.1 Detailed Description

A class of progress reporters.

5.85.2 Constructor & Destructor Documentation

5.85.2.1 ProgressReporter() [1/3]

```
mage::ProgressReporter::ProgressReporter (
    const string & title,
    uint32_t nb_work,
    char plus_char = '+',
    uint32_t bar_length = 0 ) [explicit]
```

Constructs a progress reporter.

Parameters

| | | |
|-----------------|-------------------------|---|
| <code>in</code> | <code>title</code> | A reference to the title. |
| <code>in</code> | <code>nb_work</code> | The total number of work units. |
| <code>in</code> | <code>plus_char</code> | The character representing a work unit that is already done. |
| <code>in</code> | <code>bar_length</code> | The length of the progress bar. If 0 the default length will be chosen. |

5.85.2.2 ProgressReporter() [2/3]

```
mage::ProgressReporter::ProgressReporter (
    const ProgressReporter & progress_reporter ) [delete]
```

Constructs a progress reporter from the given progress reporter.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>progress_reporter</i> | A reference to the progress reporter to copy. |
|----|--------------------------|---|

5.85.2.3 ProgressReporter() [3/3]

```
mage::ProgressReporter::ProgressReporter (
    ProgressReporter && progress_reporter ) [default]
```

Constructs a progress reporter by moving the given progress reporter.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>progress_reporter</i> | A reference to the progress reporter to move. |
|----|--------------------------|---|

5.85.2.4 ~ProgressReporter()

```
mage::ProgressReporter::~ProgressReporter ( ) [default]
```

Destructs this progress reporter.

5.85.3 Member Function Documentation

5.85.3.1 Done()

```
void mage::ProgressReporter::Done ( )
```

Finishes this progress reporter.

5.85.3.2 Initialize()

```
void mage::ProgressReporter::Initialize (
    const string & title,
    uint32_t bar_length = 0 ) [private]
```

Initializes this progress reporter.

Parameters

| | | |
|----|-------------------|---|
| in | <i>title</i> | A reference to the title. |
| in | <i>bar_length</i> | The length of the progress bar. If 0 the default length will be chosen. |

5.85.3.3 operator=() [1/2]

```
ProgressReporter& mage::ProgressReporter::operator= (
    const ProgressReporter & progress_reporter ) [delete]
```

Copies the given progress reporter to this progress reporter.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>progress_reporter</i> | A reference to the progress reporter to copy. |
|----|--------------------------|---|

Returns

A reference to the copy of the given progress reporter (i.e. this progress reporter).

5.85.3.4 operator=() [2/2]

```
ProgressReporter& mage::ProgressReporter::operator= (
    ProgressReporter && progress_reporter ) [delete]
```

Copies the given progress reporter to this progress reporter.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>progress_reporter</i> | A reference to the progress reporter to move. |
|----|--------------------------|---|

Returns

A reference to moved progress reporter (i.e. this progress reporter).

5.85.3.5 Update()

```
void mage::ProgressReporter::Update (
    uint32_t nb_work = 1 )
```

Updates this progress reporter.

Parameters

| | | |
|----|----------------|---|
| in | <i>nb_work</i> | The number of work units that are done. |
|----|----------------|---|

5.85.4 Member Data Documentation

5.85.4.1 m_buffer

```
UniquePtr< char [ ] > mage::ProgressReporter::m_buffer [private]
```

A pointer to the output buffer of this progress reporter.

5.85.4.2 m_current_pos

```
char* mage::ProgressReporter::m_current_pos [private]
```

A pointer to the current (output) character in the output buffer of this progress reporter.

5.85.4.3 m_fout

```
FILE* mage::ProgressReporter::m_fout [private]
```

A pointer to the output file stream of this progress reporter.

5.85.4.4 m_mutex

```
Mutex mage::ProgressReporter::m_mutex [private]
```

The mutex needed for updating this progress reporter.

5.85.4.5 m_nb_plusses_printed

```
uint32_t mage::ProgressReporter::m_nb_plusses_printed [private]
```

The total number of plusses that are already outputted by this progress reporter.

5.85.4.6 m_nb_plusses_total

```
uint32_t mage::ProgressReporter::m_nb_plusses_total [private]
```

The total number of plusses that need to be outputted by this progress reporter.

5.85.4.7 m_nb_work_done

```
uint32_t mage::ProgressReporter::m_nb_work_done [private]
```

The number of work units that are already done

5.85.4.8 m_nb_work_total

```
const uint32_t mage::ProgressReporter::m_nb_work_total [private]
```

The total number of work units that need to be done.

5.85.4.9 m_plus_char

```
const char mage::ProgressReporter::m_plus_char [private]
```

The character representing a work unit that is already done of this progress reporter.

5.85.4.10 m_timer

```
UniquePtr< Timer > mage::ProgressReporter::m_timer [private]
```

A pointer to the timer of this progress reporter.

5.86 mage::ReadWriteMutex Struct Reference

```
#include <lock.hpp>
```

Public Member Functions

- [ReadWriteMutex \(\)](#)
- [ReadWriteMutex \(const ReadWriteMutex &mutex\)=delete](#)
- [ReadWriteMutex \(ReadWriteMutex &&mutex\)=default](#)
- [~ReadWriteMutex \(\)](#)
- [ReadWriteMutex & operator= \(const ReadWriteMutex &mutex\)=delete](#)
- [ReadWriteMutex & operator= \(ReadWriteMutex &&mutex\)=delete](#)

Private Member Functions

- [void AcquireRead \(\)](#)
- [void ReleaseRead \(\)](#)
- [void AcquireWrite \(\)](#)
- [void ReleaseWrite \(\)](#)

Private Attributes

- [LONG m_nb_writers_waiting](#)
- [LONG m_nb_readers_waiting](#)
- [DWORD m_active_writer_readers](#)
- [HANDLE m_ready_to_read_handle](#)
- [HANDLE m_ready_to_write_handle](#)
- [CRITICAL_SECTION m_critical_section](#)

Friends

- [struct ReadWriteMutexLock](#)

5.86.1 Detailed Description

A struct of read write mutexes.

5.86.2 Constructor & Destructor Documentation

5.86.2.1 ReadWriteMutex() [1/3]

```
mage::ReadWriteMutex::ReadWriteMutex ( )
```

Constructs a read write mutex.

5.86.2.2 ReadWriteMutex() [2/3]

```
mage::ReadWriteMutex::ReadWriteMutex ( const ReadWriteMutex & mutex ) [delete]
```

Constructs a read write mutex from the given read write mutex.

Parameters

| | | |
|----|--------------|--|
| in | <i>mutex</i> | A reference to the read write mutex to copy. |
|----|--------------|--|

5.86.2.3 `ReadWriteMutex()` [3/3]

```
mage::ReadWriteMutex::ReadWriteMutex (
    ReadWriteMutex && mutex ) [default]
```

Constructs a read write mutex by moving the given read write mutex.

Parameters

| | | |
|----|--------------|--|
| in | <i>mutex</i> | A reference to the read write mutex to move. |
|----|--------------|--|

5.86.2.4 `~ReadWriteMutex()`

```
mage::ReadWriteMutex::~ReadWriteMutex ( )
```

Destructs this read write mutex.

5.86.3 Member Function Documentation**5.86.3.1 `AcquireRead()`**

```
void mage::ReadWriteMutex::AcquireRead ( ) [private]
```

Acquires a read.

5.86.3.2 `AcquireWrite()`

```
void mage::ReadWriteMutex::AcquireWrite ( ) [private]
```

Acquires a write.

5.86.3.3 `operator=()` [1/2]

```
ReadWriteMutex& mage::ReadWriteMutex::operator= (
    const ReadWriteMutex & mutex ) [delete]
```

Copies the given read write mutex to this read write mutex.

Parameters

| | | |
|----|--------------|--|
| in | <i>mutex</i> | A reference to a read write mutex to copy. |
|----|--------------|--|

Returns

A reference to the copy of the given read write mutex (i.e. this read write mutex).

5.86.3.4 operator=() [2 / 2]

```
ReadWriteMutex& mage::ReadWriteMutex::operator= (
    ReadWriteMutex && mutex ) [delete]
```

Moves the given read write mutex to this read write mutex.

Parameters

| | | |
|----|-------|--|
| in | mutex | A reference to a read write mutex to move. |
|----|-------|--|

Returns

A reference to the moved read write mutex (i.e. this read write mutex).

5.86.3.5 ReleaseRead()

```
void mage::ReadWriteMutex::ReleaseRead ( ) [private]
```

Releases a read.

5.86.3.6 ReleaseWrite()

```
void mage::ReadWriteMutex::ReleaseWrite ( ) [private]
```

Releases a write.

5.86.4 Friends And Related Function Documentation**5.86.4.1 ReadWriteMutexLock**

```
friend struct ReadWriteMutexLock [friend]
```

5.86.5 Member Data Documentation**5.86.5.1 m_active_writer_readers**

```
DWORD mage::ReadWriteMutex::m_active_writer_readers [private]
```

The active group of this read write mutex.

HIBYTE is the flag indicating a writer is active. LOWORD is the number of active readers.

5.86.5.2 m_critical_section

```
CRITICAL_SECTION mage::ReadWriteMutex::m_critical_section [private]
```

The critical section object of this read write mutex.

5.86.5.3 m_nb_readers_waiting

```
LONG mage::ReadWriteMutex::m_nb_readers_waiting [private]
```

The number of readers waiting for this read write mutex.

5.86.5.4 m_nb_writers_waiting

```
LONG mage::ReadWriteMutex::m_nb_writers_waiting [private]
```

The number of writers waiting for this read write mutex.

5.86.5.5 m_ready_to_read_handle

```
HANDLE mage::ReadWriteMutex::m_ready_to_read_handle [private]
```

The handle of this read write mutex if ready for reading.

5.86.5.6 m_ready_to_write_handle

```
HANDLE mage::ReadWriteMutex::m_ready_to_write_handle [private]
```

The handle of this read write mutex if ready for writing.

5.87 mage::ReadWriteMutexLock Struct Reference

```
#include <lock.hpp>
```

Public Member Functions

- `ReadWriteMutexLock (ReadWriteMutex &mutex, ReadWriteMutexLockType lock_type)`
- `ReadWriteMutexLock (const ReadWriteMutexLock &mutex_lock)=delete`
- `ReadWriteMutexLock (ReadWriteMutexLock &&mutex_lock)=default`
- `~ReadWriteMutexLock ()`
- `ReadWriteMutexLock & operator= (const ReadWriteMutexLock &mutex_lock)=delete`
- `ReadWriteMutexLock & operator= (ReadWriteMutexLock &&mutex_lock)=delete`
- `void UpgradeToWrite ()`
- `void DowngradeToRead ()`

Private Attributes

- `ReadWriteMutexLockType m_type`
- `ReadWriteMutex & m_mutex`

5.87.1 Detailed Description

A struct of read write mutex locks.

5.87.2 Constructor & Destructor Documentation

5.87.2.1 `ReadWriteMutexLock()` [1/3]

```
mage::ReadWriteMutexLock::ReadWriteMutexLock (
    ReadWriteMutex & mutex,
    ReadWriteMutexLockType lock_type ) [explicit]
```

Constructs a read write mutex lock for the given read write mutex and lock type.

Parameters

| | | |
|----|------------------------|------------------------------------|
| in | <code>mutex</code> | A reference to a read write mutex. |
| in | <code>lock_type</code> | The lock type. |

5.87.2.2 `ReadWriteMutexLock()` [2/3]

```
mage::ReadWriteMutexLock::ReadWriteMutexLock (
    const ReadWriteMutexLock & mutex_lock ) [delete]
```

Constructs a read write mutex lock from the given read write mutex lock.

Parameters

| | | |
|----|-------------------------|---|
| in | <code>mutex_lock</code> | A reference to the read write mutex lock to copy. |
|----|-------------------------|---|

5.87.2.3 `ReadWriteMutexLock()` [3/3]

```
mage::ReadWriteMutexLock::ReadWriteMutexLock (
    ReadWriteMutexLock && mutex_lock ) [default]
```

Constructs a read write mutex lock by moving the given read write mutex lock.

Parameters

| | | |
|----|-------------------------|---|
| in | <code>mutex_lock</code> | A reference to the read write mutex lock to move. |
|----|-------------------------|---|

5.87.2.4 ~ReadWriteMutexLock()

```
mage::ReadWriteMutexLock::~ReadWriteMutexLock ( )
```

Destructs this read write mutex lock.

5.87.3 Member Function Documentation

5.87.3.1 DowngradeToRead()

```
void mage::ReadWriteMutexLock::DowngradeToRead ( )
```

Downgrades this read write lock to read.

5.87.3.2 operator=() [1/2]

```
ReadWriteMutexLock& mage::ReadWriteMutexLock::operator= (
    const ReadWriteMutexLock & mutex_lock ) [delete]
```

Copies the given read write mutex lock to this read write mutex lock.

Parameters

| | | |
|----|-------------------|---|
| in | <i>mutex_lock</i> | A reference to the read write mutex lock to copy. |
|----|-------------------|---|

Returns

A reference to the copy of the given read write mutex lock (i.e. this read write mutex lock).

5.87.3.3 operator=() [2/2]

```
ReadWriteMutexLock& mage::ReadWriteMutexLock::operator= (
    ReadWriteMutexLock && mutex_lock ) [delete]
```

Moves the given read write mutex lock to this read write mutex lock.

Parameters

| | | |
|----|-------------------|---|
| in | <i>mutex_lock</i> | A reference to the read write mutex lock to move. |
|----|-------------------|---|

Returns

A reference to the moved read write mutex lock (i.e. this read write mutex lock).

5.87.3.4 UpgradeToWrite()

```
void mage::ReadWriteMutexLock::UpgradeToWrite ( )
```

Upgrades this read write lock to write.

5.87.4 Member Data Documentation

5.87.4.1 m_mutex

```
ReadWriteMutex& mage::ReadWriteMutexLock::m_mutex [private]
```

A reference to the read write mutex of this read write mutex lock.

5.87.4.2 m_type

```
ReadWriteMutexLockType mage::ReadWriteMutexLock::m_type [private]
```

The lock type of this read write mutex lock.

5.88 mage::Renderer Class Reference

```
#include <renderer.hpp>
```

Public Member Functions

- [Renderer \(HWND hwindow\)](#)
- [Renderer \(const Renderer &renderer\)=delete](#)
- [Renderer \(Renderer &&renderer\)](#)
- [~Renderer \(\)](#)
- [Renderer & operator= \(const Renderer &renderer\)=delete](#)
- [Renderer & operator= \(Renderer &&renderer\)=delete](#)
- [uint32_t GetWidth \(\) const](#)
- [uint32_t GetHeight \(\) const](#)
- [ID3D11Device2 * GetDevice \(\) const](#)
- [ID3D11DeviceContext2 * GetDeviceContext \(\) const](#)
- [RenderingState * GetRenderingState2D \(\) const](#)
- [RenderingState * GetRenderingState3D \(\) const](#)
- [bool IsWindowed \(\) const](#)
- [bool IsFullScreen \(\) const](#)
- [bool LostMode \(\) const](#)
- [void SwitchMode \(bool toggle\)](#)
- [void BeginFrame \(\)](#)
- [void EndFrame \(\)](#)
- [void PrepareRendering2D \(\)](#)
- [void PrepareRendering3D \(\)](#)

Private Member Functions

- void [InitializeRenderer \(\)](#)
- void [UninitializeRenderer \(\)](#)
- void [SetupDevice \(\)](#)
- void [SetupSwapChain \(\)](#)
- void [SetupRTV \(\)](#)
- void [SetupDSV \(\)](#)
- void [SetupRenderingStates \(\)](#)
- void [SetupViewPort \(\) const](#)

Private Attributes

- const HWND [m_hwindow](#)
- bool [m_fullscreen](#)
- bool [m_in_begin_end_pair](#)
- DXGI_MODE_DESC1 [m_display_mode](#)
- D3D_FEATURE_LEVEL [m_feature_level](#)
- ComPtr< ID3D11Device2 > [m_device](#)
- ComPtr< ID3D11DeviceContext2 > [m_device_context](#)
- ComPtr< IDXGISwapChain2 > [m_swap_chain](#)
- ComPtr< ID3D11RenderTargetView > [m_rtv](#)
- ComPtr< ID3D11DepthStencilView > [m_dsv](#)
- UniquePtr< RenderingState > [m_rendering_state_2d](#)
- UniquePtr< RenderingState > [m_rendering_state_3d](#)
- UniquePtr< RenderingStateCache > [m_rendering_state_cache](#)

5.88.1 Detailed Description

A class of renderers.

5.88.2 Constructor & Destructor Documentation

5.88.2.1 Renderer() [1/3]

```
mage::Renderer::Renderer (
    HWND hwindow ) [explicit]
```

Constructs a renderer.

Parameters

| | | |
|-----------------|----------------------|-------------------------|
| <code>in</code> | <code>hwindow</code> | The main window handle. |
|-----------------|----------------------|-------------------------|

5.88.2.2 Renderer() [2/3]

```
mage::Renderer::Renderer (
    const Renderer & renderer ) [delete]
```

Constructs a renderer from the given renderer.

Parameters

| | | |
|----|-----------------|------------------------------------|
| in | <i>renderer</i> | A reference to a renderer to copy. |
|----|-----------------|------------------------------------|

5.88.2.3 Renderer() [3/3]

```
mage::Renderer::Renderer (   
    Renderer && renderer ) [default]
```

Constructs a renderer by moving the given renderer.

Parameters

| | | |
|----|-----------------|------------------------------------|
| in | <i>renderer</i> | A reference to a renderer to move. |
|----|-----------------|------------------------------------|

5.88.2.4 ~Renderer()

```
mage::Renderer::~Renderer ( )
```

Destructs this renderer.

5.88.3 Member Function Documentation

5.88.3.1 BeginFrame()

```
void mage::Renderer::BeginFrame ( )
```

Begins the rendering of the current frame.

Precondition

This renderer is not inside a begin/end pair.

5.88.3.2 EndFrame()

```
void mage::Renderer::EndFrame ( )
```

Ends the rendering of the current frame.

Precondition

This renderer is inside a begin/end pair.

5.88.3.3 GetDevice()

```
ID3D11Device2* mage::Renderer::GetDevice () const
```

Returns the device of this renderer.

Returns

A pointer to the device of this renderer.

5.88.3.4 GetDeviceContext()

```
ID3D11DeviceContext2* mage::Renderer::GetDeviceContext () const
```

Returns the device context of this renderer.

Returns

A pointer to the device context of this renderer.

5.88.3.5 GetHeight()

```
uint32_t mage::Renderer::GetHeight () const
```

Returns the height in pixels of the display of this renderer.

Returns

The height in pixels of the display of this renderer.

5.88.3.6 GetRenderingState2D()

```
RenderingState* mage::Renderer::GetRenderingState2D () const
```

Returns the 2D rendering state of this renderer.

Returns

A pointer to the 2D rendering state of this renderer.

5.88.3.7 GetRenderingState3D()

```
RenderingState* mage::Renderer::GetRenderingState3D () const
```

Returns the 3D rendering state of this renderer.

Returns

A pointer to the 3D rendering state of this renderer.

5.88.3.8 GetWidth()

```
uint32_t mage::Renderer::GetWidth ( ) const
```

Returns the width in pixels of the display of this renderer.

Returns

The width in pixels of the display of this renderer.

5.88.3.9 InitializeRenderer()

```
void mage::Renderer::InitializeRenderer ( ) [private]
```

Initializes this renderer.

Exceptions

| | |
|---------------------------|-------------------------------------|
| <i>FormattedException</i> | Failed to initialize this renderer. |
|---------------------------|-------------------------------------|

5.88.3.10 IsFullScreen()

```
bool mage::Renderer::IsFullScreen ( ) const
```

Checks whether this renderer renders in full screen mode.

Returns

`true` if this renderer renders in full screen mode. `false` otherwise.

5.88.3.11 IsWindowed()

```
bool mage::Renderer::IsWindowed ( ) const
```

Checks whether this renderer renders in windowed mode.

Returns

`true` if this renderer renders in windowed mode. `false` otherwise.

5.88.3.12 LostMode()

```
bool mage::Renderer::LostMode ( ) const
```

Checks whether this renderer lost its mode, i.e. the current mode of this renderer differs from the current mode of its swap chain (due to for example ALT + TAB).

Returns

`true` if this renderer lost its mode. `false` otherwise.

5.88.3.13 operator=() [1/2]

```
Renderer& mage::Renderer::operator= (
    const Renderer & renderer ) [delete]
```

Copies the given renderer to this renderer.

Parameters

| | | |
|----|----------|------------------------------------|
| in | renderer | A reference to a renderer to copy. |
|----|----------|------------------------------------|

Returns

A reference to the copy of the given renderer (i.e. this renderer).

5.88.3.14 operator=() [2/2]

```
Renderer& mage::Renderer::operator= (
    Renderer && renderer ) [delete]
```

Moves the given renderer to this renderer.

Parameters

| | | |
|----|----------|------------------------------------|
| in | renderer | A reference to a renderer to move. |
|----|----------|------------------------------------|

Returns

A reference to the moved renderer (i.e. this renderer).

5.88.3.15 PrepareRendering2D()

```
void mage::Renderer::PrepareRendering2D ( )
```

Prepares the 2D rendering of the current frame.

5.88.3.16 PrepareRendering3D()

```
void mage::Renderer::PrepareRendering3D ( )
```

Prepares the 3D rendering of the current frame.

5.88.3.17 SetupDevice()

```
void mage::Renderer::SetupDevice ( ) [private]
```

Sets up the D3D11 device and context of this renderer.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set up the device and device context of this renderer. |
|---------------------------|--|

5.88.3.18 SetupDSV()

```
void mage::Renderer::SetupDSV ( ) [private]
```

Sets up the depth stencil view of this renderer.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to set up the depth stencil view of this renderer. |
|---------------------------|---|

5.88.3.19 SetupRenderingStates()

```
void mage::Renderer::SetupRenderingStates ( ) [private]
```

Sets up the rendering states of this renderer.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set up the rendering states this renderer. |
|---------------------------|--|

5.88.3.20 SetupRTV()

```
void mage::Renderer::SetupRTV ( ) [private]
```

Sets up the render target view of this renderer.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to set up the render target view of this renderer. |
|---------------------------|---|

5.88.3.21 SetupSwapChain()

```
void mage::Renderer::SetupSwapChain ( ) [private]
```

Sets up the swap chain of this renderer.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to set up the swap chain of this renderer. |
|---------------------------|---|

5.88.3.22 SetupViewPort()

```
void mage::Renderer::SetupViewPort ( ) const [private]
```

Sets up and binds the viewport of this renderer to the graphics pipeline.

5.88.3.23 SwitchMode()

```
void mage::Renderer::SwitchMode (
    bool toggle )
```

Recreates the swap chain buffers and switches the mode of this renderer. Windowed mode is switched to full screen mode and vice versa.

Parameters

| | | |
|----|---------------|--|
| in | <i>toggle</i> | If <code>true</code> only the swap chain buffers will be recreated to match the current mode of the swap chain and no mode switch will occur. If <code>false</code> both the swap chain buffers will be replaced and a mode switch will occur. |
|----|---------------|--|

5.88.3.24 UninitializeRenderer()

```
void mage::Renderer::UninitializeRenderer ( ) [private]
```

Uninitializes this renderer.

5.88.4 Member Data Documentation

5.88.4.1 m_device

```
ComPtr< ID3D11Device2 > mage::Renderer::m_device [private]
```

A pointer to the device of this renderer.

5.88.4.2 m_device_context

```
ComPtr< ID3D11DeviceContext2 > mage::Renderer::m_device_context [private]
```

A pointer to the device context of this renderer.

5.88.4.3 m_display_mode

```
DXGI_MODE_DESC1 mage::Renderer::m_display_mode [private]
```

A pointer to the display mode of this renderer.

5.88.4.4 m_dsv

```
ComPtr< ID3D11DepthStencilView > mage::Renderer::m_dsv [private]
```

A pointer to the depth stencil view of this renderer.

5.88.4.5 m_feature_level

```
D3D_FEATURE_LEVEL mage::Renderer::m_feature_level [private]
```

A pointer to the feature level of this renderer.

5.88.4.6 m_fullscreen

```
bool mage::Renderer::m_fullscreen [private]
```

A flag indicating whether this renderer uses a full screen mode or not (i.e. a windowed mode).

5.88.4.7 m_hwindow

```
const HWND mage::Renderer::m_hwindow [private]
```

The handle of the parent window of this renderer.

5.88.4.8 m_in_begin_end_pair

```
bool mage::Renderer::m_in_begin_end_pair [private]
```

A flag indicating whether this renderer is inside a begin/end pair.

5.88.4.9 m_rendering_state_2d

```
UniquePtr< RenderingState > mage::Renderer::m_rendering_state_2d [private]
```

A pointer to the 2D rendering state of this renderer.

5.88.4.10 m_rendering_state_3d

```
UniquePtr< RenderingState > mage::Renderer::m_rendering_state_3d [private]
```

A pointer to the 3D rendering state of this renderer.

5.88.4.11 m_rendering_state_cache

```
UniquePtr< RenderingStateCache > mage::Renderer::m_rendering_state_cache [private]
```

A pointer to the rendering state cache of this renderer.

5.88.4.12 m_rtv

```
ComPtr< ID3D11RenderTargetView > mage::Renderer::m_rtv [private]
```

A pointer to the render target view of this renderer.

5.88.4.13 m_swap_chain

```
ComPtr< IDXGISwapChain2 > mage::Renderer::m_swap_chain [private]
```

A pointer to the swap chain of this renderer.

5.89 mage::RenderingState Struct Reference

```
#include <rendering_state.hpp>
```

Public Member Functions

- `RenderingState` (`ID3D11Device2` *`device`, `ID3D11DeviceContext2` *`device_context`, `RenderingContextCache` *`rendering_state_cache`)
- `RenderingState` (const `RenderingContext` &`rendering_state`)
- `RenderingContext` (`RenderingContext` &&`rendering_state`)
- `~RenderingContext` ()
- `RenderingContext` & `operator=` (const `RenderingContext` &`rendering_state`)=delete
- `RenderingContext` & `operator=` (`RenderingContext` &&`rendering_state`)=delete
- `void PrepareRendering` ()
- `void SetDefaultRenderingContext2D` ()
- `void SetDefaultRenderingContext3D` ()
- `void SetBlendState` (`ID3D11BlendState` *`blend_state`)
- `void SetOpaqueBlendState` ()
- `void SetAlphaBlendState` ()
- `void SetAdditiveBlendState` ()
- `void SetNonPremultipliedBlendState` ()
- `ID3D11BlendState` * `GetBlendState` () const
- `void SetDepthStencilState` (`ID3D11DepthStencilState` *`depth_stencil_state`)
- `void SetDepthNoneDepthStencilState` ()
- `void SetDepthDefaultDepthStencilState` ()
- `void SetDepthReadDepthStencilState` ()
- `ID3D11DepthStencilState` * `GetDepthStencilState` () const
- `void SetRasterizerState` (`ID3D11RasterizerState` *`rasterizer_state`)
- `void SetCullNoneRasterizerState` ()
- `void SetCullClockwiseRasterizerState` ()
- `void SetCullCounterClockwiseRasterizerState` ()
- `void SetWireframeRasterizerState` ()
- `ID3D11RasterizerState` * `GetRasterizerState` () const
- `void SetSamplerState` (`ID3D11SamplerState` *`sampler_state`)
- `void SetPointWrapSamplerState` ()
- `void SetPointClampSamplerState` ()
- `void SetLinearWrapSamplerState` ()
- `void SetLinearClampSamplerState` ()
- `void SetAnisotropicWrapSamplerState` ()
- `void SetAnisotropicClampSamplerState` ()
- `ID3D11SamplerState` * `GetSamplerState` () const

Private Attributes

- ID3D11Device2 *const `m_device`
- ID3D11DeviceContext2 *const `m_device_context`
- `RenderingStateCache` *const `m_rendering_state_cache`
- ID3D11BlendState * `m_blend_state`
- ID3D11DepthStencilState * `m_depth_stencil_state`
- ID3D11RasterizerState * `m_rasterizer_state`
- ID3D11SamplerState * `m_sampler_state`

5.89.1 Detailed Description

A struct of rendering states containing a blend, depth stencil, rasterizer and sampler state for rendering.

5.89.2 Constructor & Destructor Documentation

5.89.2.1 RenderingState() [1/3]

```
mage::RenderingState::RenderingState (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    RenderingStateCache * rendering_state_cache ) [explicit]
```

Constructs a rendering state.

Precondition

`device` is not equal to `nullptr`.
`device_context` is not equal to `nullptr`.
`rendering_state_cache` is not equal to `nullptr`.

Parameters

| | | |
|----|------------------------------------|---|
| in | <code>device</code> | A pointer to the device. |
| in | <code>device_context</code> | A pointer to the device context. |
| in | <code>rendering_state_cache</code> | A pointer to the rendering state cache. |

5.89.2.2 RenderingState() [2/3]

```
mage::RenderingState::RenderingState (
    const RenderingState & rendering_state ) [default]
```

Constructs a rendering state from the given rendering state.

Parameters

| | | |
|----|------------------------------|---|
| in | <code>rendering_state</code> | A reference to the rendering state to copy. |
|----|------------------------------|---|

5.89.2.3 RenderingState() [3/3]

```
mage::RenderingState::RenderingState (
    RenderingState && rendering_state ) [default]
```

Constructs a rendering state by moving the given rendering state.

Parameters

| | | |
|----|------------------------|---|
| in | <i>rendering_state</i> | A reference to the rendering state to move. |
|----|------------------------|---|

5.89.2.4 ~RenderingState()

```
mage::RenderingState::~RenderingState () [default]
```

Destructs this rendering state.

5.89.3 Member Function Documentation

5.89.3.1 GetBlendState()

```
ID3D11BlendState* mage::RenderingState::GetBlendState () const
```

Returns the blend state of this rendering state.

Returns

A pointer to the blend state of this rendering state.

5.89.3.2 GetDepthStencilState()

```
ID3D11DepthStencilState* mage::RenderingState::GetDepthStencilState () const
```

Returns the depth stencil state of this rendering state.

Returns

A pointer to the depth stencil state of this rendering state.

5.89.3.3 GetRasterizerState()

```
ID3D11RasterizerState* mage::RenderingState::GetRasterizerState () const
```

Returns the rasterizer state of this rendering state.

Returns

A pointer to the rasterizer state of this rendering state.

5.89.3.4 GetSamplerState()

```
ID3D11SamplerState* mage::RenderingState::GetSamplerState ( ) const
```

Returns the sampler state of this rendering state.

Returns

A pointer to the sampler state of this rendering state.

5.89.3.5 operator=() [1/2]

```
RenderingState& mage::RenderingState::operator= (
    const RenderingState & rendering_state ) [delete]
```

Copies the given rendering state to this rendering state.

Parameters

| | | |
|----|------------------------|---|
| in | <i>rendering_state</i> | A reference to the rendering state to copy. |
|----|------------------------|---|

Returns

A reference to the copy of the given rendering state (i.e. this rendering state).

5.89.3.6 operator=() [2/2]

```
RenderingState& mage::RenderingState::operator= (
    RenderingState && rendering_state ) [delete]
```

Moves the given rendering state to this rendering state.

Parameters

| | | |
|----|------------------------|---|
| in | <i>rendering_state</i> | A reference to the rendering state to move. |
|----|------------------------|---|

Returns

A reference to the moved rendering state (i.e. this rendering state).

5.89.3.7 PrepareRendering()

```
void mage::RenderingState::PrepareRendering ( )
```

Prepares this rendering state for rendering.

Precondition

All states (blend, depth stencil, rasterizer, sampler) of this rendering state must be set.

5.89.3.8 SetAdditiveBlendState()

```
void mage::RenderingState::SetAdditiveBlendState ( )
```

Sets the blend state of this rendering state to the an additive blend state.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the blend state of this rendering state. |
|---------------------------|--|

5.89.3.9 SetAlphaBlendState()

```
void mage::RenderingState::SetAlphaBlendState ( )
```

Sets the blend state of this rendering state to the an alpha blend state.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the blend state of this rendering state. |
|---------------------------|--|

5.89.3.10 SetAnisotropicClampSamplerState()

```
void mage::RenderingState::SetAnisotropicClampSamplerState ( )
```

Sets the sampler state of this rendering state to an anisotropic sampling state with clamping.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the sampler state of this rendering state. |
|---------------------------|--|

5.89.3.11 SetAnisotropicWrapSamplerState()

```
void mage::RenderingState::SetAnisotropicWrapSamplerState ( )
```

Sets the sampler state of this rendering state to an anisotropic sampling state with wrapping.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the sampler state of this rendering state. |
|---------------------------|--|

5.89.3.12 SetBlendState()

```
void mage::RenderingState::SetBlendState ( ID3D11BlendState * blend_state )
```

Sets the blend state of this rendering state to the given blend state.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the blend state of this rendering state. |
|---------------------------|--|

5.89.3.13 SetCullClockwiseRasterizerState()

```
void mage::RenderingState::SetCullClockwiseRasterizerState ( )
```

Sets the rasterizer state of this rendering state to the a clockwise-culling rasterizer state.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to set the rasterizer state of this rendering state. |
|---------------------------|---|

5.89.3.14 SetCullCounterClockwiseRasterizerState()

```
void mage::RenderingState::SetCullCounterClockwiseRasterizerState ( )
```

Sets the rasterizer state of this rendering state to the a counter-clockwise-culling rasterizer state.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to set the rasterizer state of this rendering state. |
|---------------------------|---|

5.89.3.15 SetCullNoneRasterizerState()

```
void mage::RenderingState::SetCullNoneRasterizerState ( )
```

Sets the rasterizer state of this rendering state to the a no-culling rasterizer state.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to set the rasterizer state of this rendering state. |
|---------------------------|---|

5.89.3.16 SetDefaultRenderingState2D()

```
void mage::RenderingState::SetDefaultRenderingState2D ( )
```

Sets the states (blend, depth stencil, rasterizer, sampler) of this rendering state to the default rendering states for 2D rendering.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to set the states of this rendering state. |
|---------------------------|---|

5.89.3.17 SetDefaultRenderingState3D()

```
void mage::RenderingState::SetDefaultRenderingState3D ( )
```

Sets the states (blend, depth stencil, rasterizer, sampler) of this rendering state to the default rendering states for 3D rendering.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to set the states of this rendering state. |
|---------------------------|---|

5.89.3.18 SetDepthDefaultDepthStencilState()

```
void mage::RenderingState::SetDepthDefaultDepthStencilState ( )
```

Sets the depth stencil state of this rendering state to the a default depth stencil state.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the depth stencil state of this rendering state. |
|---------------------------|--|

5.89.3.19 SetDepthNoneDepthStencilState()

```
void mage::RenderingState::SetDepthNoneDepthStencilState ( )
```

Sets the depth stencil state of this rendering state to the a no-depth stencil state.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the depth stencil state of this rendering state. |
|---------------------------|--|

5.89.3.20 SetDepthReadDepthStencilState()

```
void mage::RenderingState::SetDepthReadDepthStencilState ( )
```

Sets the depth stencil state of this rendering state to the a read depth stencil state.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the depth stencil state of this rendering state. |
|---------------------------|--|

5.89.3.21 SetDepthStencilState()

```
void mage::RenderingState::SetDepthStencilState (
    ID3D11DepthStencilState * depth_stencil_state )
```

Sets the depth stencil state of this rendering state to the given depth stencil state.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the depth stencil state of this rendering state. |
|---------------------------|--|

5.89.3.22 SetLinearClampSamplerState()

```
void mage::RenderingState::SetLinearClampSamplerState ( )
```

Sets the sampler state of this rendering state to a linear sampling state with clamping.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the sampler state of this rendering state. |
|---------------------------|--|

5.89.3.23 SetLinearWrapSamplerState()

```
void mage::RenderingState::SetLinearWrapSamplerState ( )
```

Sets the sampler state of this rendering state to a linear sampling state with wrapping.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the sampler state of this rendering state. |
|---------------------------|--|

5.89.3.24 SetNonPremultipliedBlendState()

```
void mage::RenderingState::SetNonPremultipliedBlendState ( )
```

Sets the blend state of this rendering state to the a non-premultiplied blend state.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the blend state of this rendering state. |
|---------------------------|--|

5.89.3.25 SetOpaqueBlendState()

```
void mage::RenderingState::SetOpaqueBlendState ( )
```

Sets the blend state of this rendering state to the an opaque blend state.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the blend state of this rendering state. |
|---------------------------|--|

5.89.3.26 SetPointClampSamplerState()

```
void mage::RenderingState::SetPointClampSamplerState ( )
```

Sets the sampler state of this rendering state to a point sampling state with clamping.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the sampler state of this rendering state. |
|---------------------------|--|

5.89.3.27 SetPointWrapSamplerState()

```
void mage::RenderingState::SetPointWrapSamplerState ( )
```

Sets the sampler state of this rendering state to a point sampling state with wrapping.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the sampler state of this rendering state. |
|---------------------------|--|

5.89.3.28 SetRasterizerState()

```
void mage::RenderingState::SetRasterizerState (
    ID3D11RasterizerState * rasterizer_state )
```

Sets the rasterizer state of this rendering state to the given rasterizer state.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to set the rasterizer state of this rendering state. |
|---------------------------|---|

5.89.3.29 SetSamplerState()

```
void mage::RenderingState::SetSamplerState (
    ID3D11SamplerState * sampler_state )
```

Sets the sampler state of this rendering state to the given sampler state.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to set the sampler state of this rendering state. |
|---------------------------|--|

5.89.3.30 SetWireframeRasterizerState()

```
void mage::RenderingState::SetWireframeRasterizerState ( )
```

Sets the rasterizer state of this rendering state to the a wireframe rasterizer state.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to set the rasterizer state of this rendering state. |
|---------------------------|---|

5.89.4 Member Data Documentation

5.89.4.1 m_blend_state

```
ID3D11BlendState* mage::RenderingState::m_blend_state [private]
```

A pointer to the blend state of this rendering state.

5.89.4.2 m_depth_stencil_state

```
ID3D11DepthStencilState* mage::RenderingState::m_depth_stencil_state [private]
```

A pointer to the depth stencil state of this rendering state.

5.89.4.3 m_device

```
ID3D11Device2* const mage::RenderingState::m_device [private]
```

A pointer to the device of this rendering state.

5.89.4.4 m_device_context

```
ID3D11DeviceContext2* const mage::RenderingState::m_device_context [private]
```

A pointer to the device context of this rendering state.

5.89.4.5 m_rasterizer_state

```
ID3D11RasterizerState* mage::RenderingState::m_rasterizer_state [private]
```

A pointer to the rasterizer state of this rendering state.

5.89.4.6 m_rendering_state_cache

```
RenderingStateCache* const mage::RenderingState::m_rendering_state_cache [private]
```

A pointer to the rendering state cache of this rendering state.

5.89.4.7 m_sampler_state

`ID3D11SamplerState* mage::RenderingState::m_sampler_state [private]`

A pointer to the sampler state of this rendering state.

5.90 mage::RenderingStateCache Struct Reference

```
#include <rendering_state_cache.hpp>
```

Public Member Functions

- `RenderingStateCache (ID3D11Device2 *device)`
- `RenderingStateCache (const RenderingStateCache &rendering_state_cache)=delete`
- `RenderingStateCache (RenderingStateCache &&rendering_state_cache)`
- `~RenderingStateCache ()`
- `RenderingStateCache & operator= (const RenderingStateCache &rendering_state_cache)=delete`
- `RenderingStateCache & operator= (RenderingStateCache &&rendering_state_cache)=delete`
- `ID3D11BlendState * GetOpaqueBlendState ()`
- `ID3D11BlendState * GetAlphaBlendState ()`
- `ID3D11BlendState * GetAdditiveBlendState ()`
- `ID3D11BlendState * GetNonPremultipliedBlendState ()`
- `ID3D11DepthStencilState * GetDepthNoneDepthStencilState ()`
- `ID3D11DepthStencilState * GetDepthDefaultDepthStencilState ()`
- `ID3D11DepthStencilState * GetDepthReadDepthStencilState ()`
- `ID3D11RasterizerState * GetCullNoneRasterizerState ()`
- `ID3D11RasterizerState * GetCullClockwiseRasterizerState ()`
- `ID3D11RasterizerState * GetCullCounterClockwiseRasterizerState ()`
- `ID3D11RasterizerState * GetWireframeRasterizerState ()`
- `ID3D11SamplerState * GetPointWrapSamplerState ()`
- `ID3D11SamplerState * GetPointClampSamplerState ()`
- `ID3D11SamplerState * GetLinearWrapSamplerState ()`
- `ID3D11SamplerState * GetLinearClampSamplerState ()`
- `ID3D11SamplerState * GetAnisotropicWrapSamplerState ()`
- `ID3D11SamplerState * GetAnisotropicClampSamplerState ()`

Private Attributes

- `ID3D11Device2 *const m_device`
- `ComPtr< ID3D11BlendState > m_opaque_blend_state`
- `ComPtr< ID3D11BlendState > m_alpha_blend_state`
- `ComPtr< ID3D11BlendState > m_additive_blend_state`
- `ComPtr< ID3D11BlendState > m_non_premultiplied_blend_state`
- `ComPtr< ID3D11DepthStencilState > m_depth_none_depth_stencil_state`
- `ComPtr< ID3D11DepthStencilState > m_depth_default_depth_stencil_state`
- `ComPtr< ID3D11DepthStencilState > m_depth_read_depth_stencil_state`
- `ComPtr< ID3D11RasterizerState > m_cull_none_rasterizer_state`
- `ComPtr< ID3D11RasterizerState > m_cull_clockwise_rasterizer_state`
- `ComPtr< ID3D11RasterizerState > m_cull_counter_clockwise_rasterizer_state`
- `ComPtr< ID3D11RasterizerState > m_wireframe_rasterizer_state`
- `ComPtr< ID3D11SamplerState > m_point_wrap_sampler_state`
- `ComPtr< ID3D11SamplerState > m_point_clamp_sampler_state`
- `ComPtr< ID3D11SamplerState > m_linear_wrap_sampler_state`
- `ComPtr< ID3D11SamplerState > m_linear_clamp_sampler_state`
- `ComPtr< ID3D11SamplerState > m_anisotropic_wrap_sampler_state`
- `ComPtr< ID3D11SamplerState > m_anisotropic_clamp_sampler_state`
- `Mutex m_mutex`

5.90.1 Detailed Description

A struct of rendering state caches.

5.90.2 Constructor & Destructor Documentation

5.90.2.1 `RenderingStateCache()` [1/3]

```
mage::RenderingStateCache::RenderingStateCache (
    ID3D11Device2 * device ) [explicit]
```

Constructs a rendering state cache.

Precondition

device is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|--------------------------|
| in | <i>device</i> | A pointer to the device. |
|----|---------------|--------------------------|

5.90.2.2 `RenderingStateCache()` [2/3]

```
mage::RenderingStateCache::RenderingStateCache (
    const RenderingStateCache & rendering_state_cache ) [delete]
```

Constructs a rendering state cache from the given rendering state cache.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>rendering_state_cache</i> | A reference to the rendering state cache to copy. |
|----|------------------------------|---|

5.90.2.3 `RenderingStateCache()` [3/3]

```
mage::RenderingStateCache::RenderingStateCache (
    RenderingStateCache && rendering_state_cache ) [default]
```

Constructs a rendering state cache by moving the given rendering state cache.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>rendering_state_cache</i> | A reference to the rendering state cache to move. |
|----|------------------------------|---|

5.90.2.4 ~RenderingStateCache()

```
mage::RenderingStateCache::~RenderingStateCache () [default]
```

Destructs this rendering state cache.

5.90.3 Member Function Documentation

5.90.3.1 GetAdditiveBlendState()

```
ID3D11BlendState * mage::RenderingStateCache::GetAdditiveBlendState ()
```

Returns the additive blend state of this rendering cache.

Returns

A pointer to the additive blend state of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the blend state of this rendering state cache. |
|---------------------------|---|

5.90.3.2 GetAlphaBlendState()

```
ID3D11BlendState * mage::RenderingStateCache::GetAlphaBlendState ()
```

Returns the alpha blend state of this rendering cache.

Returns

A pointer to the alpha blend state of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the blend state of this rendering state cache. |
|---------------------------|---|

5.90.3.3 GetAnisotropicClampSamplerState()

```
ID3D11SamplerState * mage::RenderingStateCache::GetAnisotropicClampSamplerState ()
```

Returns the anisotropic sampling state with clamping of this rendering cache.

Returns

A pointer to the anisotropic sampling state with clamping of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the sampler state of this rendering state cache. |
|---------------------------|---|

5.90.3.4 GetAnisotropicWrapSamplerState()

```
ID3D11SamplerState * mage::RenderingStateCache::GetAnisotropicWrapSamplerState ( )
```

Returns the anisotropic sampling state with wrapping of this rendering cache.

Returns

A pointer to the anisotropic sampling state with wrapping of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the sampler state of this rendering state cache. |
|---------------------------|---|

5.90.3.5 GetCullClockwiseRasterizerState()

```
ID3D11RasterizerState * mage::RenderingStateCache::GetCullClockwiseRasterizerState ( )
```

Returns the clockwise-culling rasterizer state of this rendering cache.

Returns

A pointer to the clockwise-culling rasterizer state of this rendering cache.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to create the rasterizer state of this rendering state cache. |
|---------------------------|--|

5.90.3.6 GetCullCounterClockwiseRasterizerState()

```
ID3D11RasterizerState * mage::RenderingStateCache::GetCullCounterClockwiseRasterizerState ( )
```

Returns the counter-clockwise-culling rasterizer state of this rendering cache.

Returns

A pointer to the counter-clockwise-culling rasterizer state of this rendering cache.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to create the rasterizer state of this rendering state cache. |
|---------------------------|--|

5.90.3.7 GetCullNoneRasterizerState()

```
ID3D11RasterizerState * mage::RenderingStateCache::GetCullNoneRasterizerState ( )
```

Returns the no-culling rasterizer state of this rendering cache.

Returns

A pointer to the no-culling rasterizer state of this rendering cache.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to create the rasterizer state of this rendering state cache. |
|---------------------------|--|

5.90.3.8 GetDepthDefaultDepthStencilState()

```
ID3D11DepthStencilState * mage::RenderingStateCache::GetDepthDefaultDepthStencilState ( )
```

Returns the default depth stencil state of this rendering cache.

Returns

A pointer to the read depth stencil state of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the depth stencil state of this rendering state cache. |
|---------------------------|---|

5.90.3.9 GetDepthNoneDepthStencilState()

```
ID3D11DepthStencilState * mage::RenderingStateCache::GetDepthNoneDepthStencilState ( )
```

Returns the no-depth stencil state of this rendering cache.

Returns

A pointer to the read depth stencil state of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the depth stencil state of this rendering state cache. |
|---------------------------|---|

5.90.3.10 GetDepthReadDepthStencilState()

```
ID3D11DepthStencilState * mage::RenderingStateCache::GetDepthReadDepthStencilState ( )
```

Returns the read depth stencil state of this rendering cache.

Returns

A pointer to the read depth stencil state of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the depth stencil state of this rendering state cache. |
|---------------------------|---|

5.90.3.11 GetLinearClampSamplerState()

```
ID3D11SamplerState * mage::RenderingStateCache::GetLinearClampSamplerState ( )
```

Returns the linear sampling state with clamping of this rendering cache.

Returns

A pointer to the linear sampling state with clamping of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the sampler state of this rendering state cache. |
|---------------------------|---|

5.90.3.12 GetLinearWrapSamplerState()

```
ID3D11SamplerState * mage::RenderingStateCache::GetLinearWrapSamplerState ( )
```

Returns the point sampling state with wrapping of this rendering cache.

Returns

A pointer to the point sampling state with wrapping of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the sampler state of this rendering state cache. |
|---------------------------|---|

5.90.3.13 GetNonPremultipliedBlendState()

```
ID3D11BlendState * mage::RenderingStateCache::GetNonPremultipliedBlendState ( )
```

Returns the non-premultiplied blend state of this rendering cache.

Returns

A pointer to the non-premultiplied blend state of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the blend state of this rendering state cache. |
|---------------------------|---|

5.90.3.14 GetOpaqueBlendState()

```
ID3D11BlendState * mage::RenderingStateCache::GetOpaqueBlendState ( )
```

Returns the opaque blend state of this rendering cache.

Returns

A pointer to the opaque blend state of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the blend state of this rendering state cache. |
|---------------------------|---|

5.90.3.15 GetPointClampSamplerState()

```
ID3D11SamplerState * mage::RenderingStateCache::GetPointClampSamplerState ( )
```

Returns the point sampling state with clamping of this rendering cache.

Returns

A pointer to the point sampling state with clamping of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the sampler state of this rendering state cache. |
|---------------------------|---|

5.90.3.16 GetPointWrapSamplerState()

```
ID3D11SamplerState * mage::RenderingStateCache::GetPointWrapSamplerState ( )
```

Returns the point sampling state with wrapping of this rendering cache.

Returns

A pointer to the point sampling state with wrapping of this rendering cache.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the sampler state of this rendering state cache. |
|---------------------------|---|

5.90.3.17 GetWireframeRasterizerState()

```
ID3D11RasterizerState * mage::RenderingStateCache::GetWireframeRasterizerState ( )
```

Returns the wireframe rasterizer state of this rendering cache.

Returns

A pointer to the wireframe rasterizer state of this rendering cache.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to create the rasterizer state of this rendering state cache. |
|---------------------------|--|

5.90.3.18 operator=() [1/2]

```
RenderingStateCache& mage::RenderingStateCache::operator= (
    const RenderingStateCache & rendering_state_cache ) [delete]
```

Copies the given rendering state cache to this rendering state cache.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>rendering_state_cache</i> | A reference to the rendering state cache to copy. |
|----|------------------------------|---|

Returns

A reference to the copy of the given rendering state cache (i.e. this rendering state cache).

5.90.3.19 operator=() [2/2]

```
RenderingStateCache& mage::RenderingStateCache::operator= (
    RenderingStateCache && rendering_state_cache ) [delete]
```

Moves the given rendering state cache to this rendering state cache.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>rendering_state_cache</i> | A reference to the rendering state cache to move. |
|----|------------------------------|---|

Returns

A reference to the moved rendering state cache (i.e. this rendering state cache).

5.90.4 Member Data Documentation

5.90.4.1 m_additive_blend_state

```
ComPtr< ID3D11BlendState > mage::RenderingStateCache::m_additive_blend_state [private]
```

A pointer to the additive blend state of this rendering cache.

5.90.4.2 m_alpha_blend_state

```
ComPtr< ID3D11BlendState > mage::RenderingStateCache::m_alpha_blend_state [private]
```

A pointer to the alpha blend state of this rendering cache.

5.90.4.3 m_anisotropic_clamp_sampler_state

```
ComPtr< ID3D11SamplerState > mage::RenderingStateCache::m_anisotropic_clamp_sampler_state [private]
```

A pointer to the anisotropic sampling state with clamping of this rendering cache.

5.90.4.4 m_anisotropic_wrap_sampler_state

```
ComPtr< ID3D11SamplerState > mage::RenderingStateCache::m_anisotropic_wrap_sampler_state [private]
```

A pointer to the anisotropic sampling state with wrapping of this rendering cache.

5.90.4.5 m_cull_clockwise_rasterizer_state

```
ComPtr< ID3D11RasterizerState > mage::RenderingStateCache::m_cull_clockwise_rasterizer_state [private]
```

A pointer to the clockwise-culling rasterizer state of this rendering cache.

5.90.4.6 m_cull_counter_clockwise_rasterizer_state

```
ComPtr< ID3D11RasterizerState > mage::RenderingStateCache::m_cull_counter_clockwise_rasterizer_state [private]
```

A pointer to the counter-clockwise-culling rasterizer state of this rendering cache.

5.90.4.7 m_cull_none_rasterizer_state

```
ComPtr< ID3D11RasterizerState > mage::RenderingStateCache::m_cull_none_rasterizer_state [private]
```

A pointer to the no-culling rasterizer state of this rendering cache.

5.90.4.8 m_depth_default_depth_stencil_state

```
ComPtr< ID3D11DepthStencilState > mage::RenderingStateCache::m_depth_default_depth_stencil_state [private]
```

A pointer to the default depth stencil state of this rendering cache.

5.90.4.9 m_depth_none_depth_stencil_state

```
ComPtr< ID3D11DepthStencilState > mage::RenderingStateCache::m_depth_none_depth_stencil_state [private]
```

A pointer to the no-depth stencil state of this rendering cache.

5.90.4.10 m_depth_read_depth_stencil_state

```
ComPtr< ID3D11DepthStencilState > mage::RenderingStateCache::m_depth_read_depth_stencil_state [private]
```

A pointer to the read depth stencil state of this rendering cache.

5.90.4.11 m_device

```
ID3D11Device2* const mage::RenderingStateCache::m_device [private]
```

The device of this rendering state.

5.90.4.12 m_linear_clamp_sampler_state

```
ComPtr< ID3D11SamplerState > mage::RenderingStateCache::m_linear_clamp_sampler_state [private]
```

A pointer to the linear sampling state with clamping of this rendering cache.

5.90.4.13 m_linear_wrap_sampler_state

```
ComPtr< ID3D11SamplerState > mage::RenderingStateCache::m_linear_wrap_sampler_state [private]
```

A pointer to the linear sampling state with wrapping of this rendering cache.

5.90.4.14 m_mutex

```
Mutex mage::RenderingStateCache::m_mutex [private]
```

The mutex of this rendering state cache.

5.90.4.15 m_non_premultiplied_blend_state

`ComPtr< ID3D11BlendState > mage::RenderingStateCache::m_non_premultiplied_blend_state [private]`

A pointer to the non-premultiplied blend state of this rendering cache.

5.90.4.16 m_opaque_blend_state

`ComPtr< ID3D11BlendState > mage::RenderingStateCache::m_opaque_blend_state [private]`

A pointer to the opaque blend state of this rendering cache.

5.90.4.17 m_point_clamp_sampler_state

`ComPtr< ID3D11SamplerState > mage::RenderingStateCache::m_point_clamp_sampler_state [private]`

A pointer to the point sampling state with clamping of this rendering cache.

5.90.4.18 m_point_wrap_sampler_state

`ComPtr< ID3D11SamplerState > mage::RenderingStateCache::m_point_wrap_sampler_state [private]`

A pointer to the point sampling state with wrapping of this rendering cache.

5.90.4.19 m_wireframe_rasterizer_state

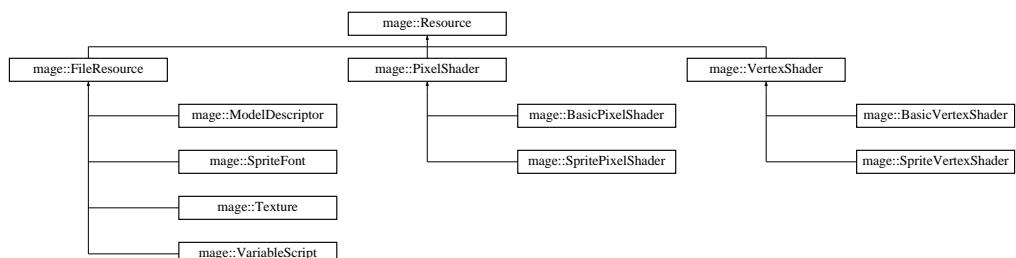
`ComPtr< ID3D11RasterizerState > mage::RenderingStateCache::m_wireframe_rasterizer_state [private]`

A pointer to the wireframe rasterizer state of this rendering cache.

5.91 mage::Resource Class Reference

```
#include <resource.hpp>
```

Inheritance diagram for mage::Resource:



Public Member Functions

- `Resource (const wstring &guid)`
- `Resource (const Resource &resource)=delete`
- `Resource (Resource &&resource)`
- `virtual ~Resource ()`
- `Resource & operator= (const Resource &resource)=delete`
- `Resource & operator= (Resource &&resource)=delete`
- `const wstring & GetGuid () const`

Private Attributes

- `const wstring m_guid`

5.91.1 Detailed Description

A class of resources.

5.91.2 Constructor & Destructor Documentation

5.91.2.1 `Resource()` [1/3]

```
mage::Resource::Resource (
    const wstring & guid ) [explicit]
```

Constructs a resource with a given globally unique identifier.

Parameters

| | | |
|----|-------------------|--|
| in | <code>guid</code> | A reference to the globally unique identifier. |
|----|-------------------|--|

5.91.2.2 `Resource()` [2/3]

```
mage::Resource::Resource (
    const Resource & resource ) [delete]
```

Constructs a resource from the given resource.

Parameters

| | | |
|----|-----------------------|--------------------------------------|
| in | <code>resource</code> | A reference to the resource to copy. |
|----|-----------------------|--------------------------------------|

5.91.2.3 `Resource()` [3/3]

```
mage::Resource::Resource (
    Resource && resource ) [default]
```

Constructs a resource by moving the given resource.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>resource</i> | A reference to the resource to move. |
|----|-----------------|--------------------------------------|

5.91.2.4 ~Resource()

```
mage::Resource::~Resource ( ) [virtual], [default]
```

Destructs this resource.

5.91.3 Member Function Documentation

5.91.3.1 GetGuid()

```
const wstring& mage::Resource::GetGuid ( ) const
```

Returns the globally unique identifier of this resource.

Returns

A reference to the globally unique identifier of this resource.

5.91.3.2 operator=() [1/2]

```
Resource& mage::Resource::operator= (
    const Resource & resource ) [delete]
```

Copies the given resource to this resource.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>resource</i> | A reference to the resource to copy. |
|----|-----------------|--------------------------------------|

Returns

A reference to the copy of the given resource (i.e. this resource).

5.91.3.3 operator=() [2/2]

```
Resource& mage::Resource::operator= (
    Resource && resource ) [delete]
```

Moves the given resource to this resource.

Parameters

| | | |
|-----------------|-----------------------|--------------------------------------|
| <code>in</code> | <code>resource</code> | A reference to the resource to move. |
|-----------------|-----------------------|--------------------------------------|

Returns

A reference to the moved resource (i.e. this resource).

5.91.4 Member Data Documentation**5.91.4.1 m_guid**

```
const wstring mage::Resource::m_guid [private]
```

The globally unique identifier of this resource.

5.92 mage::ResourceFactory Class Reference

```
#include <resource_factory.hpp>
```

Public Member Functions

- [ResourceFactory \(\)](#)
- [ResourceFactory \(const ResourceFactory &resource_factory\)=delete](#)
- [ResourceFactory \(ResourceFactory &&resource_factory\)](#)
- [virtual ~ResourceFactory \(\)](#)
- [ResourceFactory & operator= \(const ResourceFactory &resource_factory\)=delete](#)
- [ResourceFactory & operator= \(ResourceFactory &&resource_factory\)=delete](#)
- [template<typename VertexT > SharedPtr< ModelDescriptor > CreateModelDescriptor \(ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const wstring &fname, const MeshDescriptor< VertexT > &desc\)](#)
- [SharedPtr< VertexShader > CreateBasicVertexShader \(ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const CompiledVertexShader &compiled_vertex_shader\)](#)
- [SharedPtr< PixelShader > CreateBasicPixelShader \(ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const CompiledPixelShader &compiled_pixel_shader\)](#)
- [SharedPtr< VertexShader > CreateSpriteVertexShader \(ID3D11Device2 *device, ID3D11DeviceContext2 *device_context\)](#)
- [SharedPtr< PixelShader > CreateSpritePixelShader \(ID3D11Device2 *device, ID3D11DeviceContext2 *device_context\)](#)
- [SharedPtr< SpriteFont > CreateFont \(ID3D11Device2 *device, const wstring &fname, const SpriteFontDescriptor &desc\)](#)
- [SharedPtr< Texture > CreateTexture \(ID3D11Device2 *device, const wstring &fname\)](#)
- [SharedPtr< VariableScript > CreateVariableScript \(const wstring &fname, bool import\)](#)

Private Attributes

- [UniquePtr< ResourcePool< wstring, ModelDescriptor > > m_model_descriptor_resource_pool](#)
- [UniquePtr< ResourcePool< wstring, VertexShader > > m_vertex_shader_resource_pool](#)
- [UniquePtr< ResourcePool< wstring, PixelShader > > m_pixel_shader_resource_pool](#)
- [UniquePtr< ResourcePool< wstring, SpriteFont > > m_font_resource_pool](#)
- [UniquePtr< ResourcePool< wstring, Texture > > m_texture_resource_pool](#)
- [UniquePtr< ResourcePool< wstring, VariableScript > > m_variable_script_resource_pool](#)

5.92.1 Detailed Description

A class of resource factories.

5.92.2 Constructor & Destructor Documentation

5.92.2.1 ResourceFactory() [1/3]

```
mage::ResourceFactory::ResourceFactory ( )
```

Constructs a resource factory.

5.92.2.2 ResourceFactory() [2/3]

```
mage::ResourceFactory::ResourceFactory ( const ResourceFactory & resource_factory ) [delete]
```

Constructs a resource factory from the given resource factory.

Parameters

| | | |
|----|------------------|--|
| in | resource_factory | A reference to the resource factory to copy. |
|----|------------------|--|

5.92.2.3 ResourceFactory() [3/3]

```
mage::ResourceFactory::ResourceFactory ( ResourceFactory && resource_factory ) [default]
```

Constructs a resource factory by moving the given resource factory.

Parameters

| | | |
|----|------------------|--|
| in | resource_factory | A reference to the resource factory to move. |
|----|------------------|--|

5.92.2.4 ~ResourceFactory()

```
mage::ResourceFactory::~ResourceFactory ( ) [virtual]
```

Destructs this resource factory.

5.92.3 Member Function Documentation

5.92.3.1 CreateBasicPixelShader()

```
SharedPtr< PixelShader > mage::ResourceFactory::CreateBasicPixelShader ( ID3D11Device2 * device,
```

```
ID3D11DeviceContext2 * device_context,
const CompiledPixelShader & compiled_pixel_shader )
```

Creates a basic pixel shader (if not existing).

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|----|------------------------------|---|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>compiled_pixel_shader</i> | A reference to the compiled pixel shader. |

Returns

A pointer to the basic pixel shader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to create the basic pixel shader. |
|---------------------------|--|

5.92.3.2 CreateBasicVertexShader()

```
SharedPtr< VertexShader > mage::ResourceFactory::CreateBasicVertexShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const CompiledVertexShader & compiled_vertex_shader )
```

Creates a basic vertex shader (if not existing).

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|----|-------------------------------|--|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>compiled_vertex_shader</i> | A reference to the compiled vertex shader. |

Returns

A pointer to the basic vertex shader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the basic vertex shader. |
|---------------------------|---|

5.92.3.3 CreateFont()

```
SharedPtr< SpriteFont > mage::ResourceFactory::CreateFont (
    ID3D11Device2 * device,
    const wstring & fname,
    const SpriteFontDescriptor & desc )
```

Creates a sprite font (if not existing).

Precondition

device is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|--|
| in | <i>device</i> | A pointer to the device. |
| in | <i>fname</i> | A reference to the filename. |
| in | <i>desc</i> | A reference to the sprite font descriptor. |

Returns

A pointer to the sprite font.

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to create the sprite font. |
|---------------------------|-----------------------------------|

5.92.3.4 CreateModelDescriptor()

```
template<typename VertexT >
SharedPtr< ModelDescriptor > mage::ResourceFactory::CreateModelDescriptor (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const wstring & fname,
    const MeshDescriptor< VertexT > & desc )
```

Creates a model descriptor (if not existing).

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|-----------|-----------------------|-------------------------------------|
| <i>in</i> | <i>device</i> | A pointer to the device. |
| <i>in</i> | <i>device_context</i> | A pointer to the device context. |
| <i>in</i> | <i>fname</i> | A reference to the filename. |
| <i>in</i> | <i>desc</i> | A reference to the mesh descriptor. |

Returns

A pointer to the model descriptor.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to create the model descriptor. |
|---------------------------|--|

5.92.3.5 CreateSpritePixelShader()

```
SharedPtr< PixelShader > mage::ResourceFactory::CreateSpritePixelShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context )
```

Creates a sprite pixel shader (if not existing).

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|-----------|-----------------------|----------------------------------|
| <i>in</i> | <i>device</i> | A pointer to the device. |
| <i>in</i> | <i>device_context</i> | A pointer to the device context. |

Returns

A pointer to the sprite pixel shader.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to create the sprite pixel shader. |
|---------------------------|---|

5.92.3.6 CreateSpriteVertexShader()

```
SharedPtr< VertexShader > mage::ResourceFactory::CreateSpriteVertexShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context )
```

Creates a sprite vertex shader (if not existing).

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|----|-----------------------|----------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |

Returns

A pointer to the sprite vertex shader.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to create the sprite vertex shader. |
|---------------------------|--|

5.92.3.7 CreateTexture()

```
SharedPtr< Texture > mage::ResourceFactory::CreateTexture (
```

`ID3D11Device2 * device,`
`const wstring & fname)`

Creates a texture (if not existing).

Precondition

device is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>fname</i> | A reference to the filename. |

Returns

A pointer to the texture.

Exceptions

| | |
|---------------------------|-------------------------------|
| <i>FormattedException</i> | Failed to create the texture. |
|---------------------------|-------------------------------|

5.92.3.8 CreateVariableScript()

```
SharedPtr< VariableScript > mage::ResourceFactory::CreateVariableScript (
    const wstring & fname,
    bool import )
```

Creates a variable script (if not existing).

Parameters

| | | |
|----|---------------|---|
| in | <i>fname</i> | A reference to the filename of the variable script. |
| in | <i>import</i> | Flag indicating whether the variables of the variable script need to be imported. |

Returns

A pointer to the variable script.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to import the variable script from file (only possible if <i>import</i> is equal to <code>true</code>). |
|---------------------------|---|

5.92.3.9 operator=() [1/2]

```
ResourceFactory& mage::ResourceFactory::operator= (
    const ResourceFactory & resource_factory ) [delete]
```

Copies the given resource factory to this resource factory.

Parameters

| | | |
|----|-------------------------|--|
| in | <i>resource_factory</i> | A reference to the resource factory to copy. |
|----|-------------------------|--|

Returns

A reference to the copy of the given resource factory (i.e. this resource factory).

5.92.3.10 operator=() [2/2]

```
ResourceFactory& mage::ResourceFactory::operator= (
    ResourceFactory && resource_factory ) [delete]
```

Moves the given resource factory to this resource factory.

Parameters

| | | |
|----|-------------------------|--|
| in | <i>resource_factory</i> | A reference to the resource factory to move. |
|----|-------------------------|--|

Returns

A reference to the moved resource factory (i.e. this resource factory).

5.92.4 Member Data Documentation

5.92.4.1 m_font_resource_pool

```
UniquePtr< ResourcePool< wstring, SpriteFont > > mage::ResourceFactory::m_font_resource_pool  
[private]
```

A pointer to the sprite font resource pool of this resource factory.

5.92.4.2 m_model_descriptor_resource_pool

```
UniquePtr< ResourcePool< wstring, ModelDescriptor > > mage::ResourceFactory::m_model_descriptor_resource_pool  
[private]
```

A pointer to the model descriptor resource pool of this resource factory.

5.92.4.3 m_pixel_shader_resource_pool

```
UniquePtr< ResourcePool< wstring, PixelShader > > mage::ResourceFactory::m_pixel_shader_resource_pool  
[private]
```

A pointer to the pixel shader resource pool of this resource factory.

5.92.4.4 m_texture_resource_pool

```
UniquePtr< ResourcePool< wstring, Texture > > mage::ResourceFactory::m_texture_resource_pool  
[private]
```

A pointer to the texture resource pool of this resource factory.

5.92.4.5 m_variable_script_resource_pool

```
UniquePtr< ResourcePool< wstring, VariableScript > > mage::ResourceFactory::m_variable_script_resource_pool  
[private]
```

A pointer to the variable script resource pool of this resource factory.

5.92.4.6 m_vertex_shader_resource_pool

```
UniquePtr< ResourcePool< wstring, VertexShader > > mage::ResourceFactory::m_vertex_shader_resource_pool  
[private]
```

A pointer to the vertex shader resource pool of this resource factory.

5.93 mage::ResourcePool< KeyT, ResourceT > Class Template Reference

```
#include <resource_pool.hpp>
```

Classes

- struct [ResourcePoolEntry](#)

Public Member Functions

- [ResourcePool \(\)=default](#)
- [ResourcePool \(const ResourcePool &resource_pool\)=delete](#)
- [ResourcePool \(ResourcePool &&resource_pool\)](#)
- virtual [~ResourcePool \(\)](#)
- [ResourcePool & operator= \(const ResourcePool &resource_pool\)=delete](#)
- [ResourcePool & operator= \(ResourcePool &&resource_pool\)=delete](#)
- size_t [GetNumberOfResources \(\) const](#)
- template<typename... ConstructorArgsT>
[SharedPtr< ResourceT > GetResource \(KeyT key, ConstructorArgsT &&... args\)](#)
- template<typename DerivedResourceT , typename... ConstructorArgsT>
[SharedPtr< ResourceT > GetDerivedResource \(KeyT key, ConstructorArgsT &&... args\)](#)
- void [RemoveResource \(KeyT key\)](#)
- void [RemoveAllResources \(\)](#)

Private Attributes

- [ResourceMap< KeyT, ResourceT > m_resource_map](#)
- [Mutex m_resource_map_mutex](#)

5.93.1 Detailed Description

```
template<typename KeyT, typename ResourceT>
class mage::ResourcePool< KeyT, ResourceT >
```

A class of resource pools.

Template Parameters

| | |
|------------------|--------------------|
| <i>KeyT</i> | The key type. |
| <i>ResourceT</i> | The resource type. |

5.93.2 Constructor & Destructor Documentation

5.93.2.1 [ResourcePool\(\)](#) [1/3]

```
template<typename KeyT, typename ResourceT>
mage::ResourcePool< KeyT, ResourceT >::ResourcePool ( ) [default]
```

Constructs a resource pool.

5.93.2.2 ResourcePool() [2/3]

```
template<typename KeyT, typename ResourceT>
mage::ResourcePool< KeyT, ResourceT >::ResourcePool (
    const ResourcePool< KeyT, ResourceT > & resource_pool ) [delete]
```

Constructs a resource pool from the given resource pool.

Parameters

| | | |
|----|----------------------|---|
| in | <i>resource_pool</i> | A reference to the resource pool to copy. |
|----|----------------------|---|

5.93.2.3 ResourcePool() [3/3]

```
template<typename KeyT, typename ResourceT>
mage::ResourcePool< KeyT, ResourceT >::ResourcePool (
    ResourcePool< KeyT, ResourceT > && resource_pool )
```

Constructs a resource pool by moving the given resource pool.

Parameters

| | | |
|----|----------------------|---|
| in | <i>resource_pool</i> | A reference to the resource pool to move. |
|----|----------------------|---|

5.93.2.4 ~ResourcePool()

```
template<typename KeyT, typename ResourceT>
virtual mage::ResourcePool< KeyT, ResourceT >::~ResourcePool () [virtual]
```

Destructs this resource pool.

5.93.3 Member Function Documentation

5.93.3.1 GetDerivedResource()

```
template<typename KeyT, typename ResourceT>
template<typename DerivedResourceT , typename... ConstructorArgsT>
SharedPtr< ResourceT > mage::ResourcePool< KeyT, ResourceT >::GetDerivedResource (
    KeyT key,
    ConstructorArgsT &&... args )
```

Returns the resource corresponding to the given key from this resource pool.

If no resource is contained in this resource pool corresponding to the given key a new resource is created from the given arguments, added to this resource pool and returned.

Precondition

DerivedResourceT is a derived class of ResourceT.

Template Parameters

| | |
|-------------------------|--|
| <i>DerivedResourceT</i> | The derived resource type. |
| <i>ConstructorArgsT</i> | The argument types for creating a new resource of type <i>DerivedResourceT</i> . |

Parameters

| | | |
|----|-------------|---|
| in | <i>key</i> | The key of the resource. |
| in | <i>args</i> | The arguments for creating a new resource of type <i>DerivedResourceT</i> . |

Returns

A pointer to the resource corresponding to the given key from this resource pool.

5.93.3.2 GetNumberOfResources()

```
template<typename KeyT, typename ResourceT>
size_t mage::ResourcePool< KeyT, ResourceT >::GetNumberOfResources ( ) const
```

Returns the number of resources contained in this resource pool.

5.93.3.3 GetResource()

```
template<typename KeyT, typename ResourceT>
template<typename... ConstructorArgsT>
SharedPtr< ResourceT > mage::ResourcePool< KeyT, ResourceT >::GetResource (
    KeyT key,
    ConstructorArgsT &&... args )
```

Returns the resource corresponding to the given key from this resource pool.

If no resource is contained in this resource pool corresponding to the given key a new resource is created from the given arguments, added to this resource pool and returned.

Template Parameters

| | |
|-------------------------|---|
| <i>ConstructorArgsT</i> | The argument types for creating a new resource of type <i>ResourceT</i> . |
|-------------------------|---|

Parameters

| | | |
|----|-------------|--|
| in | <i>key</i> | The key of the resource. |
| in | <i>args</i> | The arguments for creating a new resource of type <i>ResourceT</i> . |

Returns

A pointer to the resource corresponding to the given key from this resource pool.

5.93.3.4 operator=() [1/2]

```
template<typename KeyT, typename ResourceT>
ResourcePool& mage::ResourcePool< KeyT, ResourceT >::operator= (
    const ResourcePool< KeyT, ResourceT > & resource_pool ) [delete]
```

Copies the given resource pool to this resource pool.

Parameters

| | | |
|----|----------------------|---|
| in | <i>resource_pool</i> | A reference to the resource pool to copy. |
|----|----------------------|---|

Returns

A reference to the copy of the given resource pool (i.e. this resource pool).

5.93.3.5 operator=() [2/2]

```
template<typename KeyT, typename ResourceT>
ResourcePool& mage::ResourcePool< KeyT, ResourceT >::operator= (
    ResourcePool< KeyT, ResourceT > && resource_pool ) [delete]
```

Moves the given resource pool to this resource pool.

Parameters

| | | |
|----|----------------------|---|
| in | <i>resource_pool</i> | A reference to the resource pool to move. |
|----|----------------------|---|

Returns

A reference to the moved resource pool (i.e. this resource pool).

5.93.3.6 RemoveAllResources()

```
template<typename KeyT, typename ResourceT>
void mage::ResourcePool< KeyT, ResourceT >::RemoveAllResources ( )
```

Removes all resources from this resource pool.

5.93.3.7 RemoveResource()

```
template<typename KeyT, typename ResourceT>
void mage::ResourcePool< KeyT, ResourceT >::RemoveResource (
    KeyT key )
```

Removes the resource corresponding to the given key from this resource pool.

Parameters

| | | |
|----|-----|------------------------------------|
| in | key | The key of the resource to remove. |
|----|-----|------------------------------------|

5.93.4 Member Data Documentation**5.93.4.1 m_resource_map**

```
template<typename KeyT, typename ResourceT>
ResourceMap< KeyT, ResourceT > mage::ResourcePool< KeyT, ResourceT >::m_resource_map [private]
```

The resource map of this resource pool.

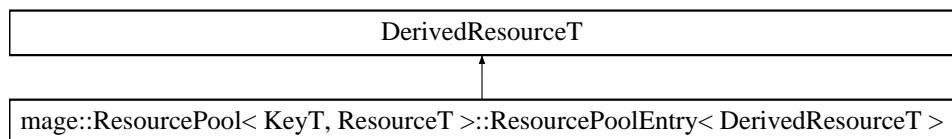
5.93.4.2 m_resource_map_mutex

```
template<typename KeyT, typename ResourceT>
Mutex mage::ResourcePool< KeyT, ResourceT >::m_resource_map_mutex [private]
```

The mutex for accessing the resource map of this resource pool.

5.94 mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry< DerivedResourceT > Struct Template Reference

Inheritance diagram for mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry< DerivedResourceT >:

**Public Member Functions**

- template<typename... ConstructorArgsT>
`ResourcePoolEntry (ResourcePool< KeyT, ResourceT > &resource_pool, KeyT resource_key, ConstructorArgsT &&... args)`
- `ResourcePoolEntry (const ResourcePoolEntry &resource)=delete`
- `ResourcePoolEntry (ResourcePoolEntry &&resource)`
- virtual `~ResourcePoolEntry ()`
- `ResourcePoolEntry & operator= (const ResourcePoolEntry &resource)=delete`
- `ResourcePoolEntry & operator= (ResourcePoolEntry &&resource)=delete`

Private Attributes

- `ResourcePool< KeyT, ResourceT > & m_resource_pool`
- `KeyT m_resource_key`

5.94.1 Detailed Description

```
template<typename KeyT, typename ResourceT>
template<typename DerivedResourceT>
struct mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry< DerivedResourceT >
```

A class of resource pool entries.

Precondition

DerivedResourceT is a derived class of ResourceT.

Template Parameters

| | |
|-------------------------|----------------------------|
| <i>DerivedResourceT</i> | The derived resource type. |
|-------------------------|----------------------------|

5.94.2 Constructor & Destructor Documentation

5.94.2.1 ResourcePoolEntry() [1/3]

```
template<typename KeyT, typename ResourceT>
template<typename DerivedResourceT >
template<typename... ConstructorArgsT>
mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry< DerivedResourceT >::ResourcePoolEntry<
    (ResourcePool< KeyT, ResourceT > & resource_pool,
     KeyT resource_key,
     ConstructorArgsT &&... args )
```

Constructs a resource pool entry.

Template Parameters

| | |
|-------------------------|--|
| <i>ConstructorArgsT</i> | The argument types for creating a new resource of type DerivedResourceT. |
|-------------------------|--|

Parameters

| | | |
|----|----------------------|---|
| in | <i>resource_pool</i> | A reference to the resource pool. |
| in | <i>resource_key</i> | The key of the resource in the given resource pool. |
| in | <i>args</i> | The arguments for creating a new resource of type DerivedResourceT. |

5.94.2.2 ResourcePoolEntry() [2/3]

```
template<typename KeyT, typename ResourceT>
template<typename DerivedResourceT >
mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry< DerivedResourceT >::ResourcePoolEntry<
    (const ResourcePoolEntry< DerivedResourceT > & resource ) [delete]
```

Constructs a resource pool entry from the given resource pool entry.

Parameters

| | | |
|----|-----------------|---|
| in | <i>resource</i> | A reference to the resource pool entry to copy. |
|----|-----------------|---|

5.94.2.3 ResourcePoolEntry() [3/3]

```
template<typename KeyT, typename ResourceT>
template<typename DerivedResourceT >
mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry< DerivedResourceT >::ResourcePoolEntry<
Entry ( 
    ResourcePoolEntry< DerivedResourceT > && resource )
```

Constructs a resource pool entry by moving the given resource poolentry .

Parameters

| | | |
|----|-----------------|---|
| in | <i>resource</i> | A reference to the resource pool entry to move. |
|----|-----------------|---|

5.94.2.4 ~ResourcePoolEntry()

```
template<typename KeyT, typename ResourceT>
template<typename DerivedResourceT >
virtual mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry< DerivedResourceT >::~ResourcePoolEntry ( ) [virtual]
```

Destructs this resource pool entry.

5.94.3 Member Function Documentation

5.94.3.1 operator=() [1/2]

```
template<typename KeyT, typename ResourceT>
template<typename DerivedResourceT >
ResourcePoolEntry& mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry< DerivedResourceT >::operator= (
    const ResourcePoolEntry< DerivedResourceT > & resource ) [delete]
```

Copies the given resource pool entry to this resource pool entry.

Parameters

| | | |
|----|-----------------|---|
| in | <i>resource</i> | A reference to the resource pool entry to copy. |
|----|-----------------|---|

Returns

A reference to the copy of the given resource pool entry (i.e. this resource pool entry).

5.94.3.2 operator=() [2/2]

```
template<typename KeyT, typename ResourceT>
template<typename DerivedResourceT >
ResourcePoolEntry& mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry< DerivedResourceT
>::operator= (
    ResourcePoolEntry< DerivedResourceT > && resource ) [delete]
```

Moves the given resource pool entry to this resource pool entry.

Parameters

| | | |
|----|-----------------|---|
| in | <i>resource</i> | A reference to the resource pool entry to move. |
|----|-----------------|---|

Returns

A reference to the moved resource pool entry (i.e. this resource pool entry).

5.94.4 Member Data Documentation**5.94.4.1 m_resource_key**

```
template<typename KeyT, typename ResourceT>
template<typename DerivedResourceT >
KeyT mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry< DerivedResourceT >::m_resource←
_key [private]
```

The key of this resource pool entry in the resource pool map containing this resource pool entry.

5.94.4.2 m_resource_pool

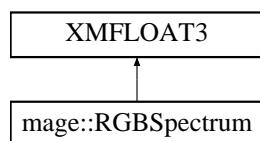
```
template<typename KeyT, typename ResourceT>
template<typename DerivedResourceT >
ResourcePool< KeyT, ResourceT >& mage::ResourcePool< KeyT, ResourceT >::ResourcePoolEntry<
DerivedResourceT >::m_resource_pool [private]
```

A reference to the resource pool map containing this resource pool entry.

5.95 mage::RGBSpectrum Struct Reference

```
#include <spectrum.hpp>
```

Inheritance diagram for mage::RGBSpectrum:



Public Member Functions

- `RGBSpectrum ()`
- `RGBSpectrum (float r, float g, float b)`
- `RGBSpectrum (const RGBSpectrum &rgb)`
- `RGBSpectrum (RGBSpectrum &&rgb)`
- `RGBSpectrum (const XYZSpectrum &xyz)`
- `RGBSpectrum (XYZSpectrum &&xyz)`
- `RGBSpectrum (const XMFLOAT3 &v)`
- `RGBSpectrum (XMFLOAT3 &&v)`
- `~RGBSpectrum ()=default`
- `RGBSpectrum & operator= (const RGBSpectrum &rgb)=default`
- `RGBSpectrum & operator= (RGBSpectrum &&rgb)=default`

5.95.1 Detailed Description

A struct of RGB color spectra.

5.95.2 Constructor & Destructor Documentation

5.95.2.1 `RGBSpectrum()` [1/8]

```
mage::RGBSpectrum::RGBSpectrum ( )
```

Constructs a RGB spectrum.

5.95.2.2 `RGBSpectrum()` [2/8]

```
mage::RGBSpectrum::RGBSpectrum (
    float r,
    float g,
    float b ) [explicit]
```

Constructs a RGB spectrum from the given spectrum components.

Parameters

| | | |
|----|----------|----------------------|
| in | <i>r</i> | The red component. |
| in | <i>g</i> | The green component. |
| in | <i>b</i> | The blue component. |

5.95.2.3 `RGBSpectrum()` [3/8]

```
mage::RGBSpectrum::RGBSpectrum (
    const RGBSpectrum & rgb )
```

Constructs a RGB spectrum from the given RGB spectrum.

Parameters

| | | |
|----|------------|--|
| in | <i>rgb</i> | A reference to the RGB spectrum to copy. |
|----|------------|--|

5.95.2.4 RGBSpectrum() [4/8]

```
mage::RGBSpectrum::RGBSpectrum (
    RGBSpectrum && rgb )
```

Constructs a RGB spectrum by moving the given RGB spectrum.

Parameters

| | | |
|----|------------|--|
| in | <i>rgb</i> | A reference to the RGB spectrum to move. |
|----|------------|--|

5.95.2.5 RGBSpectrum() [5/8]

```
mage::RGBSpectrum::RGBSpectrum (
    const XYZSpectrum & xyz ) [explicit]
```

Constructs a RGB spectrum from the given XYZ spectrum.

Parameters

| | | |
|----|------------|--|
| in | <i>xyz</i> | A reference to the XYZ spectrum to copy. |
|----|------------|--|

5.95.2.6 RGBSpectrum() [6/8]

```
mage::RGBSpectrum::RGBSpectrum (
    XYZSpectrum && xyz ) [explicit]
```

Constructs a RGB spectrum by moving the given XYZ spectrum.

Parameters

| | | |
|----|------------|--|
| in | <i>xyz</i> | A reference to the XYZ spectrum to move. |
|----|------------|--|

5.95.2.7 RGBSpectrum() [7/8]

```
mage::RGBSpectrum::RGBSpectrum (
    const XMFLOAT3 & v ) [explicit]
```

Constructs a RGB spectrum from the given components.

Parameters

| | | |
|----|---|--|
| in | v | A reference to the components to copy. |
|----|---|--|

5.95.2.8 RGBSpectrum() [8/8]

```
mage::RGBSpectrum::RGBSpectrum (
    XMFLOAT3 && v ) [explicit]
```

Constructs a RGB spectrum by moving the given components.

Parameters

| | | |
|----|---|--|
| in | v | A reference to the components to move. |
|----|---|--|

5.95.2.9 ~RGBSpectrum()

```
mage::RGBSpectrum::~RGBSpectrum () [default]
```

Destructs this RGB spectrum.

5.95.3 Member Function Documentation**5.95.3.1 operator=() [1/2]**

```
RGBSpectrum& mage::RGBSpectrum::operator= (
    const RGBSpectrum & rgb ) [default]
```

Copies the given RGB spectrum to this RGB spectrum.

Parameters

| | | |
|----|-----|--|
| in | rgb | A reference to the RGB spectrum to copy. |
|----|-----|--|

Returns

A reference to the copy of the given RGB spectrum (i.e. this RGB spectrum).

5.95.3.2 operator=() [2/2]

```
RGBSpectrum& mage::RGBSpectrum::operator= (
    RGBSpectrum && rgb ) [default]
```

Moves the given RGB spectrum to this RGB spectrum.

Parameters

| | | |
|-----------------|------------------|--|
| <code>in</code> | <code>rgb</code> | A reference to the RGB spectrum to move. |
|-----------------|------------------|--|

Returns

A reference to the moved RGB spectrum (i.e. this RGB spectrum).

5.96 mage::Scene Class Reference

```
#include <scene.hpp>
```

Public Member Functions

- `virtual ~Scene ()`
- `Scene & operator= (const Scene &scene)=delete`
- `Scene & operator= (Scene &&scene)=delete`
- `const string & GetName () const`
- `void SetName (const string &name)`
- `void Initialize ()`
- `void Update (double delta_time)`
- `void Render2D () const`
- `void Render3D () const`
- `void Uninitialize ()`
- `SharedPtr< CameraNode > GetCamera () const`
- `void SetCamera (SharedPtr< CameraNode > camera)`
- `SharedPtr< OrthographicCameraNode > CreateOrthographicCameraNode ()`
- `SharedPtr< PerspectiveCameraNode > CreatePerspectiveCameraNode ()`
- `SharedPtr< OmniLightNode > CreateOmniLightNode ()`
- `SharedPtr< SpotLightNode > CreateSpotLightNode ()`
- `SharedPtr< ModelNode > CreateModelNode (const ModelDescriptor &desc, const CombinedShader &shader=CreateLambertianShader())`
- `size_t GetNumberOfScripts () const`
- `bool HasScript (SharedPtr< const BehaviorScript > script) const`
- `void AddScript (SharedPtr< BehaviorScript > script)`
- `void RemoveScript (SharedPtr< BehaviorScript > script)`
- `void RemoveAllScripts ()`
- template<typename ActionT >
 `void ForEachScript (ActionT action) const`
- `void AddSprite (SharedPtr< SpriteObject > sprite)`
- `void RemoveSprite (SharedPtr< SpriteObject > sprite)`
- `void RemoveAllSprites ()`
- template<typename ActionT >
 `void ForEachSprite (ActionT action) const`

Protected Member Functions

- `Scene (const string &name)`
- `Scene (const Scene &scene)=delete`
- `Scene (Scene &&scene)=default`

Private Member Functions

- virtual void `Load()`
- virtual void `Close()`
- void `Clear()`
- void `AddModel(SharedPtr<ModelNode> model)`
- void `RemoveModel(SharedPtr<ModelNode> model)`
- void `RemoveAllModels()`
- template<typename ActionT>
void `ForEachModel(ActionT action) const`
- void `AddLight(SharedPtr<OmniLightNode> light)`
- void `AddLight(SharedPtr<SpotLightNode> light)`
- void `RemoveLight(SharedPtr<OmniLightNode> light)`
- void `RemoveLight(SharedPtr<SpotLightNode> light)`
- void `RemoveAllLights()`
- template<typename ActionT>
void `ForEachOmniLight(ActionT action) const`
- template<typename ActionT>
void `ForEachSpotLight(ActionT action) const`
- template<typename ActionT>
void `ForEachLight(ActionT action) const`

Private Attributes

- string `m_name`
- vector<SharedPtr<BehaviorScript>> `m_scripts`
- `SharedPtr<CameraNode> m_camera`
- vector<SharedPtr<ModelNode>> `m_models`
- vector<SharedPtr<OmniLightNode>> `m.omni_lights`
- vector<SharedPtr<SpotLightNode>> `m.spot_lights`
- vector<SharedPtr<SpriteObject>> `m_sprites`
- `SharedPtr<SpriteBatch> m_sprite_batch`
- `ConstantBuffer<TransformBuffer> m_transform_buffer`
- `ConstantBuffer<LightDataBuffer> m.light_data_buffer`
- `StructuredBuffer<OmniLightBuffer> m.omni_lights_buffer`
- `StructuredBuffer<SpotLightBuffer> m.spot_lights_buffer`

5.96.1 Constructor & Destructor Documentation

5.96.1.1 `~Scene()`

```
mage::Scene::~Scene ( ) [virtual]
```

5.96.1.2 `Scene()` [1/3]

```
mage::Scene::Scene (
    const string & name ) [explicit], [protected]
```

5.96.1.3 Scene() [2/3]

```
mage::Scene::Scene (
    const Scene & scene )  [protected], [delete]
```

5.96.1.4 Scene() [3/3]

```
mage::Scene::Scene (
    Scene && scene )  [protected], [default]
```

5.96.2 Member Function Documentation**5.96.2.1 AddLight()** [1/2]

```
void mage::Scene::AddLight (
    SharedPtr< OmniLightNode > light )  [private]
```

5.96.2.2 AddLight() [2/2]

```
void mage::Scene::AddLight (
    SharedPtr< SpotLightNode > light )  [private]
```

5.96.2.3 AddModel()

```
void mage::Scene::AddModel (
    SharedPtr< ModelNode > model )  [private]
```

5.96.2.4 AddScript()

```
void mage::Scene::AddScript (
    SharedPtr< BehaviorScript > script )
```

5.96.2.5 AddSprite()

```
void mage::Scene::AddSprite (
    SharedPtr< SpriteObject > sprite )
```

5.96.2.6 Clear()

```
void mage::Scene::Clear ( )  [private]
```

5.96.2.7 Close()

```
virtual void mage::Scene::Close ( ) [private], [virtual]
```

Closes this scene. Allows this scene to preform any post-processing destruction.

5.96.2.8 CreateModelNode()

```
SharedPtr< ModelNode > mage::Scene::CreateModelNode (
    const ModelDescriptor & desc,
    const CombinedShader & shader = CreateLambertianShader() )
```

5.96.2.9 CreateOmniLightNode()

```
SharedPtr< OmniLightNode > mage::Scene::CreateOmniLightNode ( )
```

5.96.2.10 CreateOrthographicCameraNode()

```
SharedPtr< OrthographicCameraNode > mage::Scene::CreateOrthographicCameraNode ( )
```

5.96.2.11 CreatePerspectiveCameraNode()

```
SharedPtr< PerspectiveCameraNode > mage::Scene::CreatePerspectiveCameraNode ( )
```

5.96.2.12 CreateSpotLightNode()

```
SharedPtr< SpotLightNode > mage::Scene::CreateSpotLightNode ( )
```

5.96.2.13 ForEachLight()

```
template<typename ActionT >
void mage::Scene::ForEachLight (
    ActionT action ) const [private]
```

5.96.2.14 ForEachModel()

```
template<typename ActionT >
void mage::Scene::ForEachModel (
    ActionT action ) const [private]
```

5.96.2.15 ForEachOmniLight()

```
template<typename ActionT >
void mage::Scene::ForEachOmniLight (
    ActionT action ) const [private]
```

5.96.2.16 ForEachScript()

```
template<typename ActionT >
void mage::Scene::ForEachScript (
    ActionT action ) const
```

5.96.2.17 ForEachSpotLight()

```
template<typename ActionT >
void mage::Scene::ForEachSpotLight (
    ActionT action ) const [private]
```

5.96.2.18 ForEachSprite()

```
template<typename ActionT >
void mage::Scene::ForEachSprite (
    ActionT action ) const
```

5.96.2.19 GetCamera()

```
SharedPtr< CameraNode > mage::Scene::GetCamera ( ) const
```

5.96.2.20 GetName()

```
const string& mage::Scene::GetName ( ) const
```

5.96.2.21 GetNumberOfScripts()

```
size_t mage::Scene::GetNumberOfScripts ( ) const
```

5.96.2.22 HasScript()

```
bool mage::Scene::HasScript (
    SharedPtr< const BehaviorScript > script ) const
```

5.96.2.23 Initialize()

```
void mage::Scene::Initialize ( )
```

Initializes this scene.

5.96.2.24 Load()

```
virtual void mage::Scene::Load ( ) [private], [virtual]
```

Loads this scene. Allows this scene to preform any pre-processing construction.

5.96.2.25 operator=() [1/2]

```
Scene& mage::Scene::operator= (
    const Scene & scene ) [delete]
```

5.96.2.26 operator=() [2/2]

```
Scene& mage::Scene::operator= (
    Scene && scene ) [delete]
```

5.96.2.27 RemoveAllLights()

```
void mage::Scene::RemoveAllLights ( ) [private]
```

5.96.2.28 RemoveAllModels()

```
void mage::Scene::RemoveAllModels ( ) [private]
```

5.96.2.29 RemoveAllScripts()

```
void mage::Scene::RemoveAllScripts ( )
```

5.96.2.30 RemoveAllSprites()

```
void mage::Scene::RemoveAllSprites ( )
```

5.96.2.31 RemoveLight() [1/2]

```
void mage::Scene::RemoveLight (
    SharedPtr< OmniLightNode > light ) [private]
```

5.96.2.32 RemoveLight() [2/2]

```
void mage::Scene::RemoveLight (
    SharedPtr< SpotLightNode > light ) [private]
```

5.96.2.33 RemoveModel()

```
void mage::Scene::RemoveModel (
    SharedPtr< ModelNode > model ) [private]
```

5.96.2.34 RemoveScript()

```
void mage::Scene::RemoveScript (
    SharedPtr< BehaviorScript > script )
```

5.96.2.35 RemoveSprite()

```
void mage::Scene::RemoveSprite (
    SharedPtr< SpriteObject > sprite )
```

5.96.2.36 Render2D()

```
void mage::Scene::Render2D ( ) const
```

Renders this scene.

5.96.2.37 Render3D()

```
void mage::Scene::Render3D ( ) const
```

Renders this scene.

5.96.2.38 SetCamera()

```
void mage::Scene::SetCamera (
    SharedPtr< CameraNode > camera )
```

5.96.2.39 SetName()

```
void mage::Scene::SetName (
    const string & name )
```

5.96.2.40 Uninitialize()

```
void mage::Scene::Uninitialize ( )
```

Uninitializes this scene.

5.96.2.41 Update()

```
void mage::Scene::Update (
    double delta_time )
```

Updates this scene.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

5.96.3 Member Data Documentation

5.96.3.1 m_camera

```
SharedPtr< CameraNode > mage::Scene::m_camera [private]
```

5.96.3.2 m_light_data_buffer

```
ConstantBuffer< LightDataBuffer > mage::Scene::m_light_data_buffer [private]
```

5.96.3.3 m_models

```
vector< SharedPtr< ModelNode > > mage::Scene::m_models [private]
```

5.96.3.4 m_name

```
string mage::Scene::m_name [private]
```

5.96.3.5 m_omni_lights

```
vector< SharedPtr< OmniLightNode > > mage::Scene::m_omni_lights [private]
```

5.96.3.6 m_omni_lights_buffer

```
StructuredBuffer< OmniLightBuffer > mage::Scene::m_omni_lights_buffer [private]
```

5.96.3.7 m_scripts

```
vector< SharedPtr< BehaviorScript > > mage::Scene::m_scripts [private]
```

5.96.3.8 m_spot_lights

```
vector< SharedPtr< SpotLightNode > > mage::Scene::m_spot_lights [private]
```

5.96.3.9 m_spot_lights_buffer

```
StructuredBuffer< SpotLightBuffer > mage::Scene::m_spot_lights_buffer [private]
```

5.96.3.10 m_sprite_batch

```
SharedPtr< SpriteBatch > mage::Scene::m_sprite_batch [private]
```

5.96.3.11 m_sprites

```
vector< SharedPtr < SpriteObject > > mage::Scene::m_sprites [private]
```

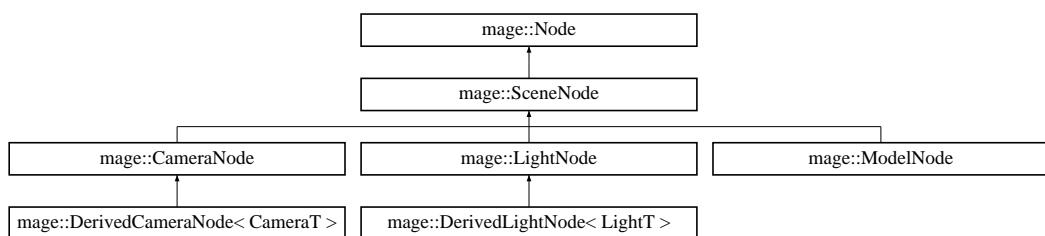
5.96.3.12 m_transform_buffer

```
ConstantBuffer< TransformBuffer > mage::Scene::m_transform_buffer [private]
```

5.97 mage::SceneNode Class Reference

```
#include <scene_node.hpp>
```

Inheritance diagram for mage::SceneNode:



Public Member Functions

- `SceneNode (const string &name)`
- `SceneNode (const SceneNode &scene_node)`
- `SceneNode (SceneNode &&scene_node)`
- `virtual ~SceneNode ()`
- `SceneNode & operator= (const SceneNode &scene_node)=delete`
- `SceneNode & operator= (SceneNode &&scene_node)=delete`
- `UniquePtr< SceneNode > Clone () const`
- `const string & GetName () const`
- `void SetName (const string &name)`

Private Member Functions

- `virtual UniquePtr< Node > CloneImplementation () const override`

Private Attributes

- `string m_name`

5.97.1 Constructor & Destructor Documentation

5.97.1.1 SceneNode() [1/3]

```
mage::SceneNode::SceneNode (
    const string & name ) [explicit]
```

5.97.1.2 SceneNode() [2/3]

```
mage::SceneNode::SceneNode (
    const SceneNode & scene_node ) [default]
```

5.97.1.3 SceneNode() [3/3]

```
mage::SceneNode::SceneNode (
    SceneNode && scene_node ) [default]
```

5.97.1.4 ~SceneNode()

```
mage::SceneNode::~SceneNode ( ) [virtual], [default]
```

5.97.2 Member Function Documentation

5.97.2.1 Clone()

```
UniquePtr< SceneNode > mage::SceneNode::Clone ( ) const
```

5.97.2.2 CloneImplementation()

```
UniquePtr< Node > mage::SceneNode::CloneImplementation ( ) const [override], [private], [virtual]
```

Clones this node.

Returns

A pointer to the clone of this node.

Reimplemented from [mage::Node](#).

Reimplemented in [mage::DerivedLightNode< LightT >](#), [mage::DerivedCameraNode< CameraT >](#), [mage::LightNode](#), [mage::CameraNode](#), and [mage::ModelNode](#).

5.97.2.3 GetName()

```
const string& mage::SceneNode::GetName ( ) const
```

5.97.2.4 operator=() [1/2]

```
SceneNode& mage::SceneNode::operator= (
    const SceneNode & scene_node ) [delete]
```

5.97.2.5 operator=() [2/2]

```
SceneNode& mage::SceneNode::operator= (
    SceneNode && scene_node ) [delete]
```

5.97.2.6 SetName()

```
void mage::SceneNode::SetName (
    const string & name )
```

5.97.3 Member Data Documentation

5.97.3.1 m_name

```
string mage::SceneNode::m_name [private]
```

5.98 mage::Semaphore Struct Reference

```
#include <lock.hpp>
```

Public Member Functions

- [Semaphore \(\)](#)
- [Semaphore \(const Semaphore &semaphore\)=delete](#)
- [Semaphore \(Semaphore &&semaphore\)=default](#)
- [~Semaphore \(\)](#)
- [Semaphore & operator= \(const Semaphore &semaphore\)=delete](#)
- [Semaphore & operator= \(Semaphore &&semaphore\)=delete](#)
- [void Signal \(uint32_t count=1\)](#)
- [void Wait \(\)](#)
- [bool TryWait \(\)](#)

Private Attributes

- HANDLE [m_handle](#)

5.98.1 Detailed Description

A struct of semaphores.

5.98.2 Constructor & Destructor Documentation

5.98.2.1 `Semaphore()` [1/3]

```
mage::Semaphore::Semaphore ( )
```

Constructs a semaphore.

5.98.2.2 `Semaphore()` [2/3]

```
mage::Semaphore::Semaphore (
    const Semaphore & semaphore ) [delete]
```

Constructs a semaphore from the given semaphore.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>semaphore</i> | A reference to the semaphore to copy. |
|----|------------------|---------------------------------------|

5.98.2.3 `Semaphore()` [3/3]

```
mage::Semaphore::Semaphore (
    Semaphore && semaphore ) [default]
```

Constructs a semaphore by moving the given semaphore.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>semaphore</i> | A reference to the semaphore to move. |
|----|------------------|---------------------------------------|

5.98.2.4 `~Semaphore()`

```
mage::Semaphore::~Semaphore ( )
```

Destructs this semaphore.

5.98.3 Member Function Documentation

5.98.3.1 `operator=()` [1/2]

```
Semaphore& mage::Semaphore::operator= (
    const Semaphore & semaphore ) [delete]
```

Copies the given semaphore to this semaphore.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>semaphore</i> | A reference to the semaphore to copy. |
|----|------------------|---------------------------------------|

Returns

A reference to the copy of the given semaphore (i.e. this semaphore)

5.98.3.2 operator=() [2/2]

```
Semaphore& mage::Semaphore::operator= (
    Semaphore && semaphore ) [delete]
```

Copies the given semaphore to this semaphore.

Parameters

| | | |
|----|------------------|---------------------------------------|
| in | <i>semaphore</i> | A reference to the semaphore to move. |
|----|------------------|---------------------------------------|

Returns

A reference to the moved semaphore (i.e. this semaphore)

5.98.3.3 Signal()

```
void mage::Semaphore::Signal (
    uint32_t count = 1 )
```

Increments the value of this semaphore variable by the given value.

If the initial value of the semaphore is negative, the waiting queue is not empty and thus one blocked process can be transferred to the ready queue.

Parameters

| | | |
|----|--------------|----------------------|
| in | <i>count</i> | The increment value. |
|----|--------------|----------------------|

5.98.3.4 TryWait()

```
bool mage::Semaphore::TryWait ( )
```

Checks whether waiting for this semaphore would be necessary.

Returns

`true` if waiting for this semaphore would be necessary. `false` otherwise.

5.98.3.5 Wait()

```
void mage::Semaphore::Wait ( )
```

Decrements the value of this semaphore variable by one.

The process executing wait is blocked until the value of the semaphore is greater or equal to 1.

5.98.4 Member Data Documentation

5.98.4.1 m_handle

```
HANDLE mage::Semaphore::m_handle [private]
```

The handle of this semaphore.

5.99 mage::ShadedMaterial Struct Reference

```
#include <shaded_material.hpp>
```

Public Member Functions

- [ShadedMaterial \(const CombinedShader &shader, const Material &material\)](#)
- [ShadedMaterial \(const ShadedMaterial &shaded_material\)=default](#)
- [ShadedMaterial \(ShadedMaterial &&shaded_material\)=default](#)
- [~ShadedMaterial \(\)=default](#)
- [ShadedMaterial & operator= \(const ShadedMaterial &shaded_material\)=default](#)
- [ShadedMaterial & operator= \(ShadedMaterial &&shaded_material\)=default](#)
- [void PrepareShading \(ID3D11Buffer *transform, const Lighting &lighting\) const](#)
- [Material & GetMaterial \(\)](#)
- [const Material & GetMaterial \(\) const](#)
- [void SetMaterial \(const Material &material\)](#)
- [const CombinedShader & GetShader \(\) const](#)
- [void SetShader \(const CombinedShader &shader\)](#)

Private Attributes

- [CombinedShader m_shader](#)
- [Material m_material](#)

5.99.1 Detailed Description

A struct of shaded materials.

5.99.2 Constructor & Destructor Documentation

5.99.2.1 ShadedMaterial() [1/3]

```
mage::ShadedMaterial::ShadedMaterial (
    const CombinedShader & shader,
    const Material & material ) [explicit]
```

Constructs a shaded material.

Parameters

| | | |
|----|-----------------|------------------------------|
| in | <i>shader</i> | A reference to the shader. |
| in | <i>material</i> | A reference to the material. |

5.99.2.2 ShadedMaterial() [2/3]

```
mage::ShadedMaterial::ShadedMaterial (
    const ShadedMaterial & shaded_material ) [default]
```

Constructs a shaded material from the given shaded material.

Parameters

| | | |
|----|------------------------|---|
| in | <i>shaded_material</i> | A reference to the shaded material to copy. |
|----|------------------------|---|

5.99.2.3 ShadedMaterial() [3/3]

```
mage::ShadedMaterial::ShadedMaterial (
    ShadedMaterial && shaded_material ) [default]
```

Constructs a shaded material by moving the given shaded material.

Parameters

| | | |
|----|------------------------|---|
| in | <i>shaded_material</i> | A reference to the shaded material to move. |
|----|------------------------|---|

5.99.2.4 ~ShadedMaterial()

```
mage::ShadedMaterial::~ShadedMaterial ( ) [default]
```

Destructs this shaded material.

5.99.3 Member Function Documentation**5.99.3.1 GetMaterial()** [1/2]

```
Material& mage::ShadedMaterial::GetMaterial ( )
```

Returns the material of this shaded material.

Returns

A reference to the material of this shaded material.

5.99.3.2 GetMaterial() [2/2]

```
const Material& mage::ShadedMaterial::GetMaterial () const
```

Returns the material of this shaded material.

Returns

A reference to the material of this shaded material.

5.99.3.3 GetShader()

```
const CombinedShader& mage::ShadedMaterial::GetShader () const
```

Returns the shader of this shaded material.

Returns

A reference to the shader of this shaded material.

5.99.3.4 operator=() [1/2]

```
ShadedMaterial& mage::ShadedMaterial::operator= (
    const ShadedMaterial & shaded_material ) [default]
```

Copies the given shaded material to this shaded material.

Parameters

| | | |
|----|------------------------|---|
| in | <i>shaded_material</i> | A reference to the shaded material to copy. |
|----|------------------------|---|

Returns

A reference to the copy of the given shaded material (i.e. this shaded material).

5.99.3.5 operator=() [2/2]

```
ShadedMaterial& mage::ShadedMaterial::operator= (
    ShadedMaterial && shaded_material ) [default]
```

Moves the given shaded material to this shaded material.

Parameters

| | | |
|----|------------------------|---|
| in | <i>shaded_material</i> | A reference to the shaded material to move. |
|----|------------------------|---|

Returns

A reference to the moved shaded material (i.e. this shaded material).

5.99.3.6 PrepareShading()

```
void mage::ShadedMaterial::PrepareShading (
    ID3D11Buffer * transform,
    const Lighting & lighting ) const
```

Prepares this shaded material for shading.

Precondition

transform is not equal to `nullptr`.

Parameters

| | | |
|----|------------------|-------------------------------------|
| in | <i>transform</i> | A pointer to the transform buffer. |
| in | <i>lighting</i> | A reference to the lighting buffer. |

5.99.3.7 SetMaterial()

```
void mage::ShadedMaterial::SetMaterial (
    const Material & material )
```

Sets the material of this shaded material to the given material.

Parameters

| | | |
|----|-----------------|------------------------------|
| in | <i>material</i> | A reference to the material. |
|----|-----------------|------------------------------|

5.99.3.8 SetShader()

```
void mage::ShadedMaterial::SetShader (
    const CombinedShader & shader )
```

Sets the shader of this shaded material to the given shader.

Parameters

| | | |
|----|---------------|----------------------------|
| in | <i>shader</i> | A reference to the shader. |
|----|---------------|----------------------------|

5.99.4 Member Data Documentation

5.99.4.1 m_material

```
Material mage::ShadedMaterial::m_material [private]
```

The material of this shaded material.

5.99.4.2 m_shader

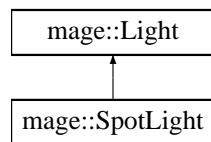
```
CombinedShader mage::ShadedMaterial::m_shader [private]
```

The shader of this shaded material.

5.100 mage::SpotLight Class Reference

```
#include <spot_light.hpp>
```

Inheritance diagram for mage::SpotLight:



Public Member Functions

- `SpotLight (const RGBSpectrum &intensity=RGBSpectrum(1.0f, 1.0f, 1.0f))`
- `SpotLight (const SpotLight &light)`
- `SpotLight (SpotLight &&light)`
- `virtual ~SpotLight ()`
- `SpotLight & operator= (const SpotLight &light)`
- `SpotLight & operator= (SpotLight &&light)`
- `UniquePtr< SpotLight > Clone () const`
- `float GetStartDistanceFalloff () const`
- `SpotLight & SetStartDistanceFalloff (float distance_falloff_start)`
- `float GetEndDistanceFalloff () const`
- `SpotLight & SetEndDistanceFalloff (float distance_falloff_end)`
- `SpotLight & SetDistanceFalloff (float distance_falloff_start, float distance_falloff_end)`
- `float GetStartAngularCutoff () const`
- `SpotLight & SetStartAngularCutoff (float cos_penumbra)`
- `float GetEndAngularCutoff () const`
- `SpotLight & SetEndAngularCutoff (float cos_umbra)`
- `SpotLight & SetAngularCutoff (float cos_penumbra, float cos_umbra)`
- `float GetPenumbraAngle () const`
- `SpotLight & SetPenumbraAngle (float penumbra)`
- `float GetUmbraAngle () const`
- `SpotLight & SetUmbraAngle (float umbra)`
- `SpotLight & SetPenumbraAndUmbraAngles (float penumbra, float umbra)`
- `float GetExponentProperty () const`
- `SpotLight & SetExponentProperty (float exponent_property)`

Private Member Functions

- virtual UniquePtr< Light > CloneImplementation () const override

Private Attributes

- float `m_exponent_property`
- float `m_distance_falloff_start`
- float `m_distance_falloff_end`
- float `m_cos_penumbra`
- float `m_cos_umbra`

Additional Inherited Members

5.100.1 Detailed Description

A class of spotlights.

5.100.2 Constructor & Destructor Documentation

5.100.2.1 SpotLight() [1/3]

```
mage::SpotLight::SpotLight (
    const RGBSpectrum & intensity = RGBSpectrum(1.0f, 1.0f, 1.0f) ) [explicit]
```

Constructs a spotlight.

Parameters

| | | |
|----|------------------|--------------------|
| in | <i>intensity</i> | The RGB intensity. |
|----|------------------|--------------------|

5.100.2.2 SpotLight() [2/3]

```
mage::SpotLight::SpotLight (
    const SpotLight & light ) [default]
```

Constructs a spotlight from the given spotlight.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>light</i> | A reference to the spotlight to copy. |
|----|--------------|---------------------------------------|

5.100.2.3 SpotLight() [3/3]

```
mage::SpotLight::SpotLight (
```

```
SpotLight && light ) [default]
```

Constructs a spotlight by moving the given spotlight.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>light</i> | A reference to the spotlight to move. |
|----|--------------|---------------------------------------|

5.100.2.4 ~SpotLight()

```
mage::SpotLight::~SpotLight ( ) [virtual], [default]
```

Destructs this spotlight.

5.100.3 Member Function Documentation

5.100.3.1 Clone()

```
UniquePtr< SpotLight > mage::SpotLight::Clone ( ) const
```

Clones this spotlight.

Returns

A pointer to the clone of this spotlight.

5.100.3.2 CloneImplementation()

```
UniquePtr< Light > mage::SpotLight::CloneImplementation ( ) const [override], [private], [virtual]
```

Clones this spotlight.

Returns

A pointer to the clone of this spotlight.

Implements [mage::Light](#).

5.100.3.3 GetEndAngularCutoff()

```
float mage::SpotLight::GetEndAngularCutoff ( ) const
```

Returns cosine of the umbra angle of this spotlight.

Returns

The cosine of the umbra angle of this spotlight.

5.100.3.4 GetEndDistanceFalloff()

```
float mage::SpotLight::GetEndDistanceFalloff ( ) const
```

Returns the end of the distance falloff of this spotlight.

Returns

The end of the distance falloff of this spotlight.

5.100.3.5 GetExponentProperty()

```
float mage::SpotLight::GetExponentProperty ( ) const
```

Returns the exponent property of this spotlight.

Returns

The exponent property of this spotlight.

5.100.3.6 GetPenumbraAngle()

```
float mage::SpotLight::GetPenumbraAngle ( ) const
```

Returns the penumbra angle (in radians) of this spotlight.

Returns

The penumbra angle (in radians) of this spotlight.

5.100.3.7 GetStartAngularCutoff()

```
float mage::SpotLight::GetStartAngularCutoff ( ) const
```

Returns cosine of the penumbra angle of this spotlight.

Returns

The cosine of the penumbra angle of this spotlight.

5.100.3.8 GetStartDistanceFalloff()

```
float mage::SpotLight::GetStartDistanceFalloff ( ) const
```

Returns the start of the distance falloff of this spotlight.

Returns

The start of the distance falloff of this spotlight.

5.100.3.9 GetUmbraAngle()

```
float mage::SpotLight::GetUmbraAngle ( ) const
```

Returns the umbra angle (in radians) of this spotlight.

Returns

The umbra angle (in radians) of this spotlight.

5.100.3.10 operator=() [1/2]

```
SpotLight & mage::SpotLight::operator= (
    const SpotLight & light ) [default]
```

Copies the given spotlight to this spotlight.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>light</i> | A reference to the spotlight to copy. |
|----|--------------|---------------------------------------|

Returns

A reference to the copy of the given spotlight (i.e. this spotlight).

5.100.3.11 operator=() [2/2]

```
SpotLight & mage::SpotLight::operator= (
    SpotLight && light ) [default]
```

Moves the given spotlight to this spotlight.

Parameters

| | | |
|----|--------------|---------------------------------------|
| in | <i>light</i> | A reference to the spotlight to move. |
|----|--------------|---------------------------------------|

Returns

A reference to the moved spotlight (i.e. this spotlight).

5.100.3.12 SetAngularCutoff()

```
SpotLight& mage::SpotLight::SetAngularCutoff (
    float cos_penumbra,
    float cos_umbra )
```

Sets the cosine of the penumbra and umbra angles of this spotlight to the given values.

Parameters

| | | |
|----|---------------------|-----------------------------------|
| in | <i>cos_penumbra</i> | The cosine of the penumbra angle. |
| in | <i>cos_umbra</i> | The cosine of the umbra angle. |

Returns

A reference to this spotlight.

5.100.3.13 SetDistanceFalloff()

```
SpotLight& mage::SpotLight::SetDistanceFalloff (
    float distance_falloff_start,
    float distance_falloff_end )
```

Sets the start and end of the distance falloff of this spotlight to the given values.

Parameters

| | | |
|----|-------------------------------|------------------------------------|
| in | <i>distance_falloff_start</i> | The start of the distance falloff. |
| in | <i>distance_falloff_end</i> | The end of the distance falloff. |

Returns

A reference to this spotlight.

5.100.3.14 SetEndAngularCutoff()

```
SpotLight& mage::SpotLight::SetEndAngularCutoff (
    float cos_umbra )
```

Sets the cosine of the umbra angle of this spotlight to the given value.

Parameters

| | | |
|----|------------------|--------------------------------|
| in | <i>cos_umbra</i> | The cosine of the umbra angle. |
|----|------------------|--------------------------------|

Returns

A reference to this spotlight.

5.100.3.15 SetEndDistanceFalloff()

```
SpotLight& mage::SpotLight::SetEndDistanceFalloff (
    float distance_falloff_end )
```

Sets the end of the distance falloff of this spotlight to the given value.

Parameters

| | | |
|----|-----------------------------|----------------------------------|
| in | <i>distance_falloff_end</i> | The end of the distance falloff. |
|----|-----------------------------|----------------------------------|

Returns

A reference to this spotlight.

5.100.3.16 SetExponentProperty()

```
SpotLight& mage::SpotLight::SetExponentProperty (
    float exponent_property )
```

Sets the exponent property of this spotlight to the given value.

Parameters

| | | |
|----|--------------------------|------------------------|
| in | <i>exponent_property</i> | The exponent property. |
|----|--------------------------|------------------------|

Returns

A reference to this spotlight.

5.100.3.17 SetPenumbraAndUmbraAngles()

```
SpotLight& mage::SpotLight::SetPenumbraAndUmbraAngles (
    float penumbra,
    float umbra )
```

Sets the penumbra and umbra angles (in radians) of this spotlight to the given values.

Parameters

| | | |
|----|-----------------|----------------------------------|
| in | <i>penumbra</i> | The penumbra angle (in radians). |
| in | <i>umbra</i> | The umbra angle (in radians). |

Returns

A reference to this spotlight.

5.100.3.18 SetPenumbraAngle()

```
SpotLight& mage::SpotLight::SetPenumbraAngle (
    float penumbra )
```

Sets the penumbra angle (in radians) of this spotlight to the given value (in radians).

Parameters

| | | |
|----|-----------------|----------------------------------|
| in | <i>penumbra</i> | The penumbra angle (in radians). |
|----|-----------------|----------------------------------|

Returns

A reference to this spotlight.

5.100.3.19 SetStartAngularCutoff()

```
SpotLight& mage::SpotLight::SetStartAngularCutoff ( float cos_penumbra )
```

Sets the cosine of the penumbra angle of this spotlight to the given value.

Parameters

| | | |
|----|---------------------|-----------------------------------|
| in | <i>cos_penumbra</i> | The cosine of the penumbra angle. |
|----|---------------------|-----------------------------------|

Returns

A reference to this spotlight.

5.100.3.20 SetStartDistanceFalloff()

```
SpotLight& mage::SpotLight::SetStartDistanceFalloff ( float distance_falloff_start )
```

Sets the start of the distance falloff of this spotlight to the given value.

Parameters

| | | |
|----|-------------------------------|------------------------------------|
| in | <i>distance_falloff_start</i> | The start of the distance falloff. |
|----|-------------------------------|------------------------------------|

Returns

A reference to this spotlight.

5.100.3.21 SetUmbraAngle()

```
SpotLight& mage::SpotLight::SetUmbraAngle ( float umbra )
```

Sets the umbra angle (in radians) of this spotlight to the given value.

Parameters

| | | |
|----|--------------|-------------------------------|
| in | <i>umbra</i> | The umbra angle (in radians). |
|----|--------------|-------------------------------|

Returns

A reference to this spotlight.

5.100.4 Member Data Documentation

5.100.4.1 m_cos_penumbra

```
float mage::SpotLight::m_cos_penumbra [private]
```

The cosine of the penumbra angle of this spotlight.

5.100.4.2 m_cos_umbra

```
float mage::SpotLight::m_cos_umbra [private]
```

The cosine of the umbra angle of this spotlight.

5.100.4.3 m_distance_falloff_end

```
float mage::SpotLight::m_distance_falloff_end [private]
```

The end of the distance falloff of this spotlight.

5.100.4.4 m_distance_falloff_start

```
float mage::SpotLight::m_distance_falloff_start [private]
```

The start of the distance falloff of this spotlight.

5.100.4.5 m_exponent_property

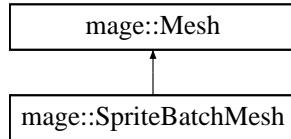
```
float mage::SpotLight::m_exponent_property [private]
```

The exponent property of this spotlight.

5.101 mage::SpriteBatchMesh Class Reference

```
#include <sprite_batch_mesh.hpp>
```

Inheritance diagram for mage::SpriteBatchMesh:



Public Member Functions

- `SpriteBatchMesh (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context)`
- `SpriteBatchMesh (const SpriteBatchMesh &sprite_batch_mesh)=delete`
- `SpriteBatchMesh (SpriteBatchMesh &&sprite_batch_mesh)`
- `virtual ~SpriteBatchMesh ()`
- `SpriteBatchMesh & operator= (const SpriteBatchMesh &sprite_batch_mesh)=delete`
- `SpriteBatchMesh & operator= (SpriteBatchMesh &&sprite_batch_mesh)=delete`
- `HRESULT MapVertexBuffer (D3D11_MAP map_type, D3D11_MAPPED_SUBRESOURCE *mapped_buffer)`
- `void UnmapVertexBuffer ()`

Static Public Member Functions

- `static constexpr size_t MinVerticesPerBatch ()`
- `static constexpr size_t MaxVerticesPerBatch ()`
- `static constexpr size_t MinIndicesPerBatch ()`
- `static constexpr size_t MaxIndicesPerBatch ()`

Static Public Attributes

- `static const size_t min_sprites_per_batch = 128`
- `static const size_t max_sprites_per_batch = 2048`
- `static const size_t vertices_per_sprite = 4`
- `static const size_t indices_per_sprite = 6`

Private Member Functions

- `void SetupVertexBuffer ()`
- `void SetupIndexBuffer ()`

Additional Inherited Members

5.101.1 Detailed Description

A class of indexed sprite batch meshes.

5.101.2 Constructor & Destructor Documentation

5.101.2.1 SpriteBatchMesh() [1/3]

```
mage::SpriteBatchMesh::SpriteBatchMesh (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context ) [explicit]
```

Constructs a sprite batch mesh.

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|----|-----------------------|----------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to setup the vertex buffer of the sprite batch mesh. |
| <i>FormattedException</i> | Failed to setup the index buffer of the sprite batch mesh. |

5.101.2.2 SpriteBatchMesh() [2/3]

```
mage::SpriteBatchMesh::SpriteBatchMesh (
    const SpriteBatchMesh & sprite_batch_mesh ) [delete]
```

Constructs a sprite batch mesh from the given sprite batch mesh.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>sprite_batch_mesh</i> | A reference to the sprite batch mesh to copy. |
|----|--------------------------|---|

5.101.2.3 SpriteBatchMesh() [3/3]

```
mage::SpriteBatchMesh::SpriteBatchMesh (
    SpriteBatchMesh && sprite_batch_mesh ) [default]
```

Constructs a sprite batch mesh by moving the given sprite batch mesh.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>sprite_batch_mesh</i> | A reference to the sprite batch mesh to move. |
|----|--------------------------|---|

5.101.2.4 ~SpriteBatchMesh()

```
mage::SpriteBatchMesh::~SpriteBatchMesh ( ) [virtual], [default]
```

Destructs this sprite batch mesh.

5.101.3 Member Function Documentation

5.101.3.1 MapVertexBuffer()

```
HRESULT mage::SpriteBatchMesh::MapVertexBuffer (
    D3D11_MAP map_type,
    D3D11_MAPPED_SUBRESOURCE * mapped_buffer )
```

Maps the vertex buffer of this this sprite batch mesh.

Precondition

mapped_buffer is not equal to `nullptr`.

Parameters

| | | |
|-----|----------------------|--|
| in | <i>map_type</i> | The map type specifying the CPU's read and write permissions for the vertex buffer of this this sprite batch mesh. |
| out | <i>mapped_buffer</i> | A pointer to the map the vertex buffer of this this sprite batch mesh to. |

Returns

A success/error value.

5.101.3.2 MaxIndicesPerBatch()

```
static constexpr size_t mage::SpriteBatchMesh::MaxIndicesPerBatch ( ) [static]
```

Returns the maximum number of indices to draw per batch for sprite batch meshes.

Returns

The maximum number of indices to draw per batch for sprite batch meshes.

5.101.3.3 MaxVerticesPerBatch()

```
static constexpr size_t mage::SpriteBatchMesh::MaxVerticesPerBatch ( ) [static]
```

Returns the maximum number of vertices to draw per batch for sprite batch meshes.

Returns

The maximum number of vertices to draw per batch for sprite batch meshes.

5.101.3.4 MinIndicesPerBatch()

```
static constexpr size_t mage::SpriteBatchMesh::MinIndicesPerBatch() [static]
```

Returns the minimum number of indices to draw per batch for sprite batch meshes.

Returns

The minimum number of indices to draw per batch for sprite batch meshes.

5.101.3.5 MinVerticesPerBatch()

```
static constexpr size_t mage::SpriteBatchMesh::MinVerticesPerBatch() [static]
```

Returns the minimum number of vertices to draw per batch for sprite batch meshes.

Returns

The minimum number of vertices to draw per batch for sprite batch meshes.

5.101.3.6 operator=() [1/2]

```
SpriteBatchMesh& mage::SpriteBatchMesh::operator= (
    const SpriteBatchMesh & sprite_batch_mesh ) [delete]
```

Copies the given sprite batch mesh to this sprite batch mesh.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>sprite_batch_mesh</i> | A reference to the sprite batch mesh to copy. |
|----|--------------------------|---|

Returns

A reference to the copy of the given sprite batch mesh (i.e. this sprite batch mesh).

5.101.3.7 operator=() [2/2]

```
SpriteBatchMesh& mage::SpriteBatchMesh::operator= (
    SpriteBatchMesh && sprite_batch_mesh ) [delete]
```

Moves the given sprite batch mesh to this sprite batch mesh.

Parameters

| | | |
|----|--------------------------|---|
| in | <i>sprite_batch_mesh</i> | A reference to the sprite batch mesh to move. |
|----|--------------------------|---|

Returns

A reference to the moved sprite batch mesh (i.e. this sprite batch mesh).

5.101.3.8 SetupIndexBuffer()

```
void mage::SpriteBatchMesh::SetupIndexBuffer ( ) [private]
```

Sets up the index buffer of this sprite batch mesh.

5.101.3.9 SetupVertexBuffer()

```
void mage::SpriteBatchMesh::SetupVertexBuffer ( ) [private]
```

Sets up the vertex buffer of this sprite batch mesh.

5.101.3.10 UnmapVertexBuffer()

```
void mage::SpriteBatchMesh::UnmapVertexBuffer ( )
```

Unmaps the vertex buffer of this sprite batch mesh.

Precondition

The vertex buffer of this sprite batch mesh must be mapped with [mage::SpriteBatchMesh::MapVertexBuffer\(D3D11_MAP, D3D11_MAPPED_SUBRESOURCE *\)](#) before it can be unmapped.

5.101.4 Member Data Documentation**5.101.4.1 indices_per_sprite**

```
const size_t mage::SpriteBatchMesh::indices_per_sprite = 6 [static]
```

The number of indices per sprite.

5.101.4.2 max_sprites_per_batch

```
const size_t mage::SpriteBatchMesh::max_sprites_per_batch = 2048 [static]
```

The maximum number of sprites to draw per batch (i.e. the maximum number of sprites that can be represented by a single sprite batch mesh) for sprite batch meshes.

5.101.4.3 min_sprites_per_batch

```
const size_t mage::SpriteBatchMesh::min_sprites_per_batch = 128 [static]
```

The minimum number of sprites to draw per batch for sprite batch meshes.

5.101.4.4 vertices_per_sprite

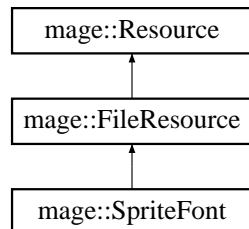
```
const size_t mage::SpriteBatchMesh::vertices_per_sprite = 4 [static]
```

The number of vertices per sprite.

5.102 mage::SpriteFont Class Reference

```
#include <sprite_font.hpp>
```

Inheritance diagram for mage::SpriteFont:



Public Member Functions

- [SpriteFont](#) (ID3D11Device2 *device, const wstring &fname, const [SpriteFontDescriptor](#) &desc=[SpriteFontDescriptor\(\)](#))
- [SpriteFont](#) (const [SpriteFont](#) &font)=delete
- [SpriteFont](#) ([SpriteFont](#) &&font)
- virtual [~SpriteFont](#) ()
- [SpriteFont & operator=](#) (const [SpriteFont](#) &font)=delete
- [SpriteFont & operator=](#) ([SpriteFont](#) &&font)=delete
- void [DrawString](#) (SpriteBatch &sprite_batch, const wchar_t *str, const SpriteTransform &transform, const XMVECTOR &color=Colors::White, [SpriteEffect](#) effects=[SpriteEffect_None](#)) const
- void [DrawString](#) (SpriteBatch &sprite_batch, const vector< [ColorString](#) > &text, const SpriteTransform &transform, [SpriteEffect](#) effects=[SpriteEffect_None](#)) const
- const XMVECTOR [MeasureString](#) (const wchar_t *str) const
- const XMVECTOR [MeasureString](#) (const vector< [ColorString](#) > &text) const
- const RECT [MeasureDrawBounds](#) (const wchar_t *str, const XMFLOAT2 &position) const
- const RECT [MeasureDrawBounds](#) (const vector< [ColorString](#) > &text, const XMFLOAT2 &position) const
- float [GetLineSpacing](#) () const
- void [SetLineSpacing](#) (float spacing)
- wchar_t [GetDefaultCharacter](#) () const
- void [SetDefaultCharacter](#) (wchar_t character)
- bool [ContainsCharacter](#) (wchar_t character) const
- const [Glyph](#) * [GetGlyph](#) (wchar_t character) const
- ID3D11ShaderResourceView * [Get](#) () const
- ID3D11ShaderResourceView *const * [GetAddress](#) () const
- ID3D11ShaderResourceView ** [GetAddress](#) ()

Private Member Functions

- void [InitializeSpriteFont](#) (const [SpriteFontOutput](#) &output)

Private Attributes

- `ComPtr< ID3D11ShaderResourceView > m_texture_srv`
- `vector< Glyph > m_glyphs`
- `const Glyph * m_default_glyph`
- `float m_line_spacing`

5.102.1 Detailed Description

A class of sprite fonts.

5.102.2 Constructor & Destructor Documentation

5.102.2.1 SpriteFont() [1/3]

```
mage::SpriteFont::SpriteFont (
    ID3D11Device2 * device,
    const wstring & fname,
    const SpriteFontDescriptor & desc = SpriteFontDescriptor() ) [explicit]
```

Constructs a sprite font.

Precondition

`device` is not equal to `nullptr`.

Parameters

| | | |
|----|---------------------|--|
| in | <code>device</code> | A pointer to the device. |
| in | <code>fname</code> | A reference to the filename. |
| in | <code>desc</code> | A reference to the sprite font descriptor. |

Exceptions

| | |
|---------------------------------|---------------------------------------|
| <code>FormattedException</code> | Failed to initialize the sprite font. |
|---------------------------------|---------------------------------------|

5.102.2.2 SpriteFont() [2/3]

```
mage::SpriteFont::SpriteFont (
    const SpriteFont & font ) [delete]
```

Constructs a sprite font from the given sprite font.

Parameters

| | | |
|----|-------------------|---|
| in | <code>font</code> | A reference to the sprite font to copy. |
|----|-------------------|---|

5.102.2.3 SpriteFont() [3/3]

```
mage::SpriteFont::SpriteFont (
    SpriteFont && font ) [default]
```

Constructs a sprite font by moving the given sprite font.

Parameters

| | | |
|----|-------------|---|
| in | <i>font</i> | A reference to the sprite font to move. |
|----|-------------|---|

5.102.4 ~SpriteFont()

```
mage::SpriteFont::~SpriteFont () [virtual], [default]
```

Destructs this sprite font.

5.102.3 Member Function Documentation

5.102.3.1 ContainsCharacter()

```
bool mage::SpriteFont::ContainsCharacter (
    wchar_t character ) const
```

Checks whether this sprite font contains a glyp matching the given character.

Parameters

| | | |
|----|------------------|----------------|
| in | <i>character</i> | The character. |
|----|------------------|----------------|

Returns

`true` if this sprite font contains a glyph corresponding to the given character. `false` otherwise.

5.102.3.2 DrawString() [1/2]

```
void mage::SpriteFont::DrawString (
    SpriteBatch & sprite_batch,
    const wchar_t * str,
    const SpriteTransform & transform,
    const XMVECTOR & color = Colors::White,
    SpriteEffect effects = SpriteEffect_None ) const
```

Draws the given string with this sprite font using the given sprite batch.

Precondition

`str` string is not equal to `nullptr`.

Parameters

| | | |
|----|---------------------|--|
| in | <i>sprite_batch</i> | A reference to the sprite batch used for rendering the given string with this sprite font. |
| in | <i>str</i> | A pointer to the first null-terminated byte string. |
| in | <i>transform</i> | A reference to the sprite transform. |
| in | <i>color</i> | A reference to the sprite color. |
| in | <i>effects</i> | The sprite effects to apply. |

5.102.3.3 DrawString() [2/2]

```
void mage::SpriteFont::DrawString (
    SpriteBatch & sprite_batch,
    const vector< ColorString > & text,
    const SpriteTransform & transform,
    SpriteEffect effects = SpriteEffect_None ) const
```

Draws the given text with this sprite font using the given sprite batch.

Parameters

| | | |
|----|---------------------|--|
| in | <i>sprite_batch</i> | A reference to the sprite batch used for rendering the given text with this sprite font. |
| in | <i>text</i> | A reference to a vector containing color strings. |
| in | <i>transform</i> | A reference to the sprite transform. |
| in | <i>effects</i> | The sprite effects to apply. |

5.102.3.4 Get()

```
ID3D11ShaderResourceView* mage::SpriteFont::Get ( ) const
```

Returns a pointer to the shader resource view of the texture of this sprite font.

Returns

A pointer to the shader resource view of the texture of this sprite font.

5.102.3.5 GetAddress() [1/2]

```
ID3D11ShaderResourceView* const* mage::SpriteFont::GetAddress ( ) const
```

Returns the address of the shader resource view of the texture of this sprite font.

Returns

A pointer to the pointer to the shader resource view of the texture of this sprite font.

5.102.3.6 GetAddress() [2/2]

```
ID3D11ShaderResourceView** mage::SpriteFont::GetAddress( )
```

Returns the address of the shader resource view of the texture of this sprite font.

Returns

A pointer to the pointer to the shader resource view of the texture of this sprite font.

5.102.3.7 GetDefaultCharacter()

```
wchar_t mage::SpriteFont::GetDefaultCharacter( ) const
```

Returns the default character of this sprite font.

If this sprite font has no default glyph, L'0' is returned.

Returns

The default character of this sprite font.

5.102.3.8 GetGlyph()

```
const Glyph * mage::SpriteFont::GetGlyph( 
    wchar_t character ) const
```

Returns the glyph of this sprite font corresponding to the given character.

Parameters

| | | |
|----|------------------|----------------|
| in | <i>character</i> | The character. |
|----|------------------|----------------|

Returns

A pointer to the default glyph of this sprite font if the given character does not match any glyphs of this sprite font and if this sprite font has a default character.

A pointer to the glyph of this sprite font corresponding to the given character.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | If the given character does not match any glyphs of this sprite font and if this sprite font has not a default character. |
|---------------------------|---|

5.102.3.9 GetLineSpacing()

```
float mage::SpriteFont::GetLineSpacing( ) const
```

Returns the line spacing of this sprite font.

Returns

The line spacing of this sprite font.

5.102.3.10 InitializeSpriteFont()

```
void mage::SpriteFont::InitializeSpriteFont (
    const SpriteFontOutput & output ) [private]
```

Initializes this sprite font with the given sprite font output.

Parameters

| | | |
|----|---------------|--|
| in | <i>output</i> | A reference to the sprite font output. |
|----|---------------|--|

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | The sprite font glyphs of the given sprite font output are not sorted. |
|---------------------------|--|

5.102.3.11 MeasureDrawBounds() [1/2]

```
const RECT mage::SpriteFont::MeasureDrawBounds (
    const wchar_t * str,
    const XMFLOAT2 & position ) const
```

Returns a rectangle bounding the given string with this sprite font.

Precondition

str string is not equal to nullptr.

Parameters

| | | |
|----|-----------------|---|
| in | <i>str</i> | A pointer to the first null-terminated byte string. |
| in | <i>position</i> | The top-left position of the string. |

Returns

A RECT bounding the given string with this sprite font.

5.102.3.12 MeasureDrawBounds() [2/2]

```
const RECT mage::SpriteFont::MeasureDrawBounds (
    const vector< ColorString > & text,
    const XMFLOAT2 & position ) const
```

Returns a rectangle bounding the given text with this sprite font.

Parameters

| | | |
|----|-----------------|---|
| in | <i>text</i> | A reference to a vector containing color strings. |
| in | <i>position</i> | The top-left position of the text. |

Returns

A RECT bounding the given text with this sprite font.

5.102.3.13 MeasureString() [1/2]

```
const XMVECTOR mage::SpriteFont::MeasureString (
    const wchar_t * str ) const
```

Returns the size of the given string with this sprite font in pixels.

Precondition

str is not equal to nullptr.

Parameters

| | | |
|----|------------|---|
| in | <i>str</i> | A pointer to the first null-terminated byte string. |
|----|------------|---|

Returns

A XMVECTOR containing the pixel width as first coordinate and pixel height as second coordinate.

Note

The string size is computed from the origin to the rightmost pixel rendered by any character glyph. This has the effect of ignoring 'trailing spaces'.

5.102.3.14 MeasureString() [2/2]

```
const XMVECTOR mage::SpriteFont::MeasureString (
    const vector< ColorString > & text ) const
```

Returns the size of the given text with this sprite font in pixels.

Parameters

| | | |
|----|-------------|---|
| in | <i>text</i> | A reference to a vector containing color strings. |
|----|-------------|---|

Returns

A *XMFLOAT2* containing the pixel width as first coordinate and pixel height as second coordinate.

Note

The text size is computed from the origin to the rightmost pixel rendered by any character glyph. This has the effect of ignoring 'trailing spaces'.

5.102.3.15 operator=() [1/2]

```
SpriteFont& mage::SpriteFont::operator= (
    const SpriteFont & font ) [delete]
```

Copies the given sprite font to this sprite font.

Parameters

| | | |
|----|-------------|---|
| in | <i>font</i> | A reference to the sprite font to copy. |
|----|-------------|---|

Returns

A reference to the copy of the given sprite font (i.e. this sprite font).

5.102.3.16 operator=() [2/2]

```
SpriteFont& mage::SpriteFont::operator= (
    SpriteFont && font ) [delete]
```

Moves the given sprite font to this sprite font.

Parameters

| | | |
|----|-------------|---|
| in | <i>font</i> | A reference to the sprite font to move. |
|----|-------------|---|

Returns

A reference to the moved sprite font (i.e. this sprite font).

5.102.3.17 SetDefaultCharacter()

```
void mage::SpriteFont::SetDefaultCharacter (
    wchar_t character )
```

Sets the default character of this sprite font to the given character.

If *character* is equal to 0, the default glyph of this sprite font is set to `nullptr`.

Parameters

| | | |
|----|------------------|----------------|
| in | <i>character</i> | The character. |
|----|------------------|----------------|

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | If the given character does not match any glyphs of this sprite font and if this sprite font has not a default character. |
|---------------------------|---|

5.102.3.18 SetLineSpacing()

```
void mage::SpriteFont::SetLineSpacing (
    float spacing )
```

Sets the line spacing of this sprite font to the given spacing value.

Parameters

| | | |
|----|----------------|-------------------|
| in | <i>spacing</i> | The line spacing. |
|----|----------------|-------------------|

5.102.4 Member Data Documentation**5.102.4.1 m_default_glyph**

```
const Glyph* mage::SpriteFont::m_default_glyph [private]
```

A pointer to the default glyph of this sprite font.

5.102.4.2 m_glyphs

```
vector< Glyph > mage::SpriteFont::m_glyphs [private]
```

A vector containing the glyphs of this sprite font.

5.102.4.3 m_line_spacing

```
float mage::SpriteFont::m_line_spacing [private]
```

The (extra) line spacing of this sprite font.

5.102.4.4 m_texture_srv

```
ComPtr< ID3D11ShaderResourceView > mage::SpriteFont::m_texture_srv [private]
```

A pointer to the texture of this sprite font.

5.103 mage::SpriteFontDescriptor Struct Reference

```
#include <sprite_font_descriptor.hpp>
```

Public Member Functions

- `SpriteFontDescriptor (bool force_srgb=false)`
- `SpriteFontDescriptor (const SpriteFontDescriptor &desc)=default`
- `SpriteFontDescriptor (SpriteFontDescriptor &&desc)=default`
- `~SpriteFontDescriptor ()=default`
- `SpriteFontDescriptor & operator= (const SpriteFontDescriptor &desc)=default`
- `SpriteFontDescriptor & operator= (SpriteFontDescriptor &&desc)=default`
- `bool ForceSRGB () const`

Private Attributes

- `bool m_force_srgb`

5.103.1 Detailed Description

A struct of sprite font descriptors.

5.103.2 Constructor & Destructor Documentation

5.103.2.1 SpriteFontDescriptor() [1/3]

```
mage::SpriteFontDescriptor::SpriteFontDescriptor (
    bool force_srgb = false ) [explicit]
```

Constructs a sprite font descriptor.

Parameters

| | | |
|-----------------|-------------------------|--|
| <code>in</code> | <code>force_srgb</code> | A flag indicating whether working around gamma issues is needed. |
|-----------------|-------------------------|--|

5.103.2.2 SpriteFontDescriptor() [2/3]

```
mage::SpriteFontDescriptor::SpriteFontDescriptor (
    const SpriteFontDescriptor & desc ) [default]
```

Constructs a sprite font descriptor from the given sprite font descriptor.

Parameters

| | | |
|-----------------|-------------------|--|
| <code>in</code> | <code>desc</code> | A reference to the sprite font descriptor to copy. |
|-----------------|-------------------|--|

5.103.2.3 SpriteFontDescriptor() [3/3]

```
mage::SpriteFontDescriptor::SpriteFontDescriptor (
    SpriteFontDescriptor && desc ) [default]
```

Constructs a sprite font descriptor by moving the given sprite font descriptor.

Parameters

| | | |
|----|------|--|
| in | desc | A reference to the sprite font descriptor to move. |
|----|------|--|

5.103.2.4 ~SpriteFontDescriptor()

```
mage::SpriteFontDescriptor::~SpriteFontDescriptor () [default]
```

Destructs this sprite font descriptor.

5.103.3 Member Function Documentation

5.103.3.1 ForceSRGB()

```
bool mage::SpriteFontDescriptor::ForceSRGB () const
```

Checks whether working around gamma issues is needed according to this sprite font descriptor.

Returns

true if working around gamma issues is needed. false if not.

5.103.3.2 operator=() [1/2]

```
SpriteFontDescriptor& mage::SpriteFontDescriptor::operator= (
    const SpriteFontDescriptor & desc ) [default]
```

Copies the given sprite font descriptor to this sprite font descriptor.

Parameters

| | | |
|----|------|--|
| in | desc | A reference to the sprite font descriptor to copy. |
|----|------|--|

Returns

A reference to the copy of the given sprite font descriptor (i.e. this sprite font descriptor).

5.103.3.3 operator=() [2/2]

```
SpriteFontDescriptor& mage::SpriteFontDescriptor::operator= (
    SpriteFontDescriptor && desc ) [default]
```

Moves the given sprite font descriptor to this sprite font descriptor.

Parameters

| | | |
|----|-------------|--|
| in | <i>desc</i> | A reference to the sprite font descriptor to move. |
|----|-------------|--|

Returns

A reference to the moved sprite font descriptor (i.e. this sprite font descriptor).

5.103.4 Member Data Documentation

5.103.4.1 m_force_srgb

```
bool mage::SpriteFontDescriptor::m_force_srgb [private]
```

A flag indicating whether working around gamma issues is needed for this sprite font descriptor.

This is helpful for color fonts that are in the sRGB or similar color space but are not encoded explicitly as an SRGB format.

5.104 mage::SpriteFontOutput Struct Reference

```
#include <sprite_font_output.hpp>
```

Public Member Functions

- `SpriteFontOutput ()=default`
- `SpriteFontOutput (const SpriteFontOutput &output)=delete`
- `SpriteFontOutput (SpriteFontOutput &&output)=default`
- `~SpriteFontOutput ()=default`
- `SpriteFontOutput & operator= (const SpriteFontOutput &output)=delete`
- `SpriteFontOutput & operator= (SpriteFontOutput &&output)=delete`

Public Attributes

- `ComPtr< ID3D11ShaderResourceView > m_texture_srv`
- `vector< Glyph > m_glyphs`
- `wchar_t m_default_character`
- `float m_line_spacing`

5.104.1 Detailed Description

A struct of sprite font outputs for storing the data of a sprite font.

5.104.2 Constructor & Destructor Documentation

5.104.2.1 SpriteFontOutput() [1/3]

```
mage::SpriteFontOutput::SpriteFontOutput ( ) [default]
```

Constructs a sprite font output.

5.104.2.2 SpriteFontOutput() [2/3]

```
mage::SpriteFontOutput::SpriteFontOutput (
    const SpriteFontOutput & output ) [delete]
```

Constructs a sprite font output from the given sprite font output.

Parameters

| | | |
|----|---------------|--|
| in | <i>output</i> | A reference to the sprite font output to copy. |
|----|---------------|--|

5.104.2.3 SpriteFontOutput() [3/3]

```
mage::SpriteFontOutput::SpriteFontOutput (
    SpriteFontOutput && output ) [default]
```

Constructs a sprite font output by moving the given sprite font output.

Parameters

| | | |
|----|---------------|--|
| in | <i>output</i> | A reference to the sprite font output to move. |
|----|---------------|--|

5.104.2.4 ~SpriteFontOutput()

```
mage::SpriteFontOutput::~SpriteFontOutput ( ) [default]
```

Destructs this sprite font output.

5.104.3 Member Function Documentation

5.104.3.1 operator=() [1/2]

```
SpriteFontOutput& mage::SpriteFontOutput::operator= (
    const SpriteFontOutput & output ) [delete]
```

Copies the given sprite font output to this sprite font output.

Parameters

| | | |
|----|---------------|--|
| in | <i>output</i> | A reference to the sprite font output to copy. |
|----|---------------|--|

Returns

A reference to the copy of the given sprite font output (i.e. this sprite font output).

5.104.3.2 operator=() [2/2]

```
SpriteFontOutput& mage::SpriteFontOutput::operator= (
    SpriteFontOutput && output ) [delete]
```

Moves the given sprite font output to this sprite font output.

Parameters

| | | |
|----|---------------|--|
| in | <i>output</i> | A reference to the sprite font output to move. |
|----|---------------|--|

Returns

A reference to the moved sprite font output (i.e. this sprite font output).

5.104.4 Member Data Documentation**5.104.4.1 m_default_character**

```
wchar_t mage::SpriteFontOutput::m_default_character
```

The default character of the sprite font of this sprite font output.

5.104.4.2 m_glyphs

```
vector< Glyph > mage::SpriteFontOutput::m_glyphs
```

A vector containing the glyphs of the sprite font of this sprite font output.

5.104.4.3 m_line_spacing

```
float mage::SpriteFontOutput::m_line_spacing
```

The (extra) line spacing of the sprite font of this sprite font output.

5.104.4.4 m_texture_srv

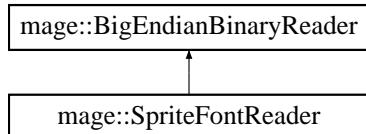
```
ComPtr< ID3D11ShaderResourceView > mage::SpriteFontOutput::m_texture_srv
```

A pointer to the texture of the sprite font of this sprite font output.

5.105 mage::SpriteFontReader Class Reference

```
#include <spritefont_reader.hpp>
```

Inheritance diagram for mage::SpriteFontReader:



Public Member Functions

- `SpriteFontReader (ID3D11Device2 *device, SpriteFontOutput &output, const SpriteFontDescriptor &desc)`
- `SpriteFontReader (const SpriteFontReader &reader)=delete`
- `SpriteFontReader (SpriteFontReader &&reader)`
- `virtual ~SpriteFontReader ()`
- `SpriteFontReader & operator= (const SpriteFontReader &reader)=delete`
- `SpriteFontReader & operator= (SpriteFontReader &&reader)=delete`

Private Member Functions

- `virtual void Read () override`
- `bool IsHeaderValid ()`
- `void ReadTexture ()`

Private Attributes

- `ID3D11Device2 *const m_device`
- `SpriteFontOutput & m_output`
- `const SpriteFontDescriptor m_desc`

Additional Inherited Members

5.105.1 Detailed Description

A class of readers for reading SPRITEFONT files.

5.105.2 Constructor & Destructor Documentation

5.105.2.1 `SpriteFontReader()` [1/3]

```
mage::SpriteFontReader::SpriteFontReader (
    ID3D11Device2 * device,
    SpriteFontOutput & output,
    const SpriteFontDescriptor & desc )  [explicit]
```

Constructs a SPRITEFONT reader.

Precondition

`device` is not equal to `nullptr`.

Parameters

| | | |
|------------|---------------|--|
| <i>in</i> | <i>device</i> | A pointer to the device. |
| <i>out</i> | <i>output</i> | A reference to the sprite font output. |
| <i>in</i> | <i>desc</i> | A reference to the sprite font descriptor. |

5.105.2.2 SpriteFontReader() [2/3]

```
mage::SpriteFontReader::SpriteFontReader (
    const SpriteFontReader & reader ) [delete]
```

Constructs a SPRITEFONT reader from the given SPRITEFONT reader.

Parameters

| | | |
|-----------|---------------|---|
| <i>in</i> | <i>reader</i> | A reference to the SPRITEFONT reader to copy. |
|-----------|---------------|---|

5.105.2.3 SpriteFontReader() [3/3]

```
mage::SpriteFontReader::SpriteFontReader (
    SpriteFontReader && reader ) [default]
```

Constructs a SPRITEFONT reader by moving the given SPRITEFONT reader.

Parameters

| | | |
|-----------|---------------|---|
| <i>in</i> | <i>reader</i> | A reference to the SPRITEFONT reader to move. |
|-----------|---------------|---|

5.105.2.4 ~SpriteFontReader()

```
mage::SpriteFontReader::~SpriteFontReader ( ) [virtual], [default]
```

Destructs this SPRITEFONT reader.

5.105.3 Member Function Documentation**5.105.3.1 IsHeaderValid()**

```
bool mage::SpriteFontReader::IsHeaderValid ( ) [private]
```

Checks whether the header of the file is valid.

Returns

`true` if the header of the file is valid. `false` otherwise.

5.105.3.2 operator=() [1/2]

```
SpriteFontReader& mage::SpriteFontReader::operator= (
    const SpriteFontReader & reader ) [delete]
```

Copies the given SPRITEFONT reader to this SPRITEFONT reader.

Parameters

| | | |
|----|--------|---|
| in | reader | A reference to a SPRITEFONT reader to copy. |
|----|--------|---|

Returns

A reference to the copy of the given SPRITEFONT reader (i.e. this SPRITEFONT reader).

5.105.3.3 operator=() [2/2]

```
SpriteFontReader& mage::SpriteFontReader::operator= (
    SpriteFontReader && reader ) [delete]
```

Moves the given SPRITEFONT reader to this SPRITEFONT reader.

Parameters

| | | |
|----|--------|---|
| in | reader | A reference to a SPRITEFONT reader to move. |
|----|--------|---|

Returns

A reference to the moved SPRITEFONT reader (i.e. this SPRITEFONT reader).

5.105.3.4 Read()

```
void mage::SpriteFontReader::Read ( ) [override], [private], [virtual]
```

Starts reading.

Exceptions

| | |
|--------------------|-----------------------------------|
| FormattedException | Failed to read to the given file. |
|--------------------|-----------------------------------|

Implements [mage::BigEndianBinaryReader](#).

5.105.3.5 ReadTexture()

```
void mage::SpriteFontReader::ReadTexture ( ) [private]
```

Reads a texture.

Exceptions

| | |
|---------------------------|---------------------------|
| <i>FormattedException</i> | Failed to read a texture. |
|---------------------------|---------------------------|

5.105.4 Member Data Documentation

5.105.4.1 m_desc

```
const SpriteFontDescriptor mage::SpriteFontReader::m_desc [private]
```

The sprite font descriptor of this SPRITEFONT reader.

5.105.4.2 m_device

```
ID3D11Device2* const mage::SpriteFontReader::m_device [private]
```

A pointer to the rendering device of this SPRITEFONT reader.

5.105.4.3 m_output

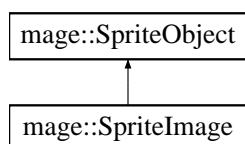
```
SpriteFontOutput& mage::SpriteFontReader::m_output [private]
```

A reference to the sprite font output of this SPRITEFONT reader.

5.106 mage::SpriteImage Class Reference

```
#include <sprite_image.hpp>
```

Inheritance diagram for mage::SpriteImage:



Public Member Functions

- `SpriteImage (const string &name, SharedPtr< Texture > texture, const Color &color, SpriteEffect effects=SpriteEffect_None)`
- `SpriteImage (const string &name, SharedPtr< Texture > texture, const RECT &texture_region, const Color &color, SpriteEffect effects=SpriteEffect_None)`
- `SpriteImage (const string &name, SharedPtr< Texture > texture, const XMVECTOR &color=Colors::White, SpriteEffect effects=SpriteEffect_None)`
- `SpriteImage (const string &name, SharedPtr< Texture > texture, const RECT &texture_region, const XMVECTOR &color=Colors::White, SpriteEffect effects=SpriteEffect_None)`
- `SpriteImage (const SpriteImage &sprite_image)`
- `SpriteImage (SpriteImage &&sprite_image)`
- `virtual ~SpriteImage ()`
- `SpriteImage & operator= (const SpriteImage &sprite_image)=delete`
- `SpriteImage & operator= (SpriteImage &&sprite_image)=delete`
- `UniquePtr< SpriteImage > Clone () const`
- `void Draw (SpriteBatch &sprite_batch) const`
- `void SetTextureRegion (const RECT &texture_region)`
- `SharedPtr< Texture > GetTexture () const`
- `void SetTexture (SharedPtr< Texture > texture)`
- `const Color GetColor () const`
- `void SetColor (const Color &color)`
- `void SetColor (const XMVECTOR &color)`

Private Member Functions

- `virtual UniquePtr< SpriteObject > CloneImplementation () const override`
- `const XMVECTOR GetColorVector () const`

Private Attributes

- `Color m_color`
- `UniquePtr< RECT > m_texture_region`
- `SharedPtr< Texture > m_texture`

Additional Inherited Members

5.106.1 Detailed Description

A class of sprite images.

5.106.2 Constructor & Destructor Documentation

5.106.2.1 `SpriteImage()` [1/6]

```
mage::SpriteImage::SpriteImage (
    const string & name,
    SharedPtr< Texture > texture,
    const Color & color,
    SpriteEffect effects = SpriteEffect_None ) [explicit]
```

Constructs a sprite image.

Precondition

`texture.get()` is not equal to `nullptr`.

Parameters

| | | |
|----|----------------|------------------------------|
| in | <i>name</i> | The name. |
| in | <i>texture</i> | A pointer to the texture. |
| in | <i>color</i> | The color. |
| in | <i>effects</i> | The sprite effects to apply. |

5.106.2.2 SpriteImage() [2/6]

```
mage::SpriteImage::SpriteImage (
    const string & name,
    SharedPtr< Texture > texture,
    const RECT & texture_region,
    const Color & color,
    SpriteEffect effects = SpriteEffect_None ) [explicit]
```

Constructs a sprite image.

Precondition

texture.get() is not equal to `nullptr`.

Parameters

| | | |
|----|-----------------------|------------------------------------|
| in | <i>name</i> | The name. |
| in | <i>texture</i> | A pointer to the texture. |
| in | <i>texture_region</i> | A reference to the texture region. |
| in | <i>color</i> | The color. |
| in | <i>effects</i> | The sprite effects to apply. |

5.106.2.3 SpriteImage() [3/6]

```
mage::SpriteImage::SpriteImage (
    const string & name,
    SharedPtr< Texture > texture,
    const XMVECTOR & color = Colors::White,
    SpriteEffect effects = SpriteEffect_None ) [explicit]
```

Constructs a sprite image.

Precondition

texture.get() is not equal to `nullptr`.

Parameters

| | | |
|----|----------------|------------------------------|
| in | <i>name</i> | The name. |
| in | <i>texture</i> | A pointer to the texture. |
| in | <i>color</i> | The color. |
| in | <i>effects</i> | The sprite effects to apply. |

5.106.2.4 SpriteImage() [4/6]

```
mage::SpriteImage::SpriteImage (
    const string & name,
    SharedPtr< Texture > texture,
    const RECT & texture_region,
    const XMVECTOR & color = Colors::White,
    SpriteEffect effects = SpriteEffect_None ) [explicit]
```

Constructs a sprite image.

Precondition

`texture.get()` is not equal to `nullptr`.

Parameters

| | | |
|----|-----------------------|------------------------------------|
| in | <i>name</i> | The name. |
| in | <i>texture</i> | A pointer to the texture. |
| in | <i>texture_region</i> | A reference to the texture region. |
| in | <i>color</i> | The color. |
| in | <i>effects</i> | The sprite effects to apply. |

5.106.2.5 SpriteImage() [5/6]

```
mage::SpriteImage::SpriteImage (
    const SpriteImage & sprite_image )
```

Constructs a sprite image from the given sprite image.

Parameters

| | | |
|----|---------------------|--|
| in | <i>sprite_image</i> | A reference to the sprite image to copy. |
|----|---------------------|--|

5.106.2.6 SpriteImage() [6/6]

```
mage::SpriteImage::SpriteImage (
    SpriteImage && sprite_image ) [default]
```

Constructs a sprite image by moving the given sprite image.

Parameters

| | | |
|----|---------------------|--|
| in | <i>sprite_image</i> | A reference to the sprite image to move. |
|----|---------------------|--|

5.106.2.7 ~SpriteImage()

```
mage::SpriteImage::~SpriteImage ( ) [virtual], [default]
```

Destruct this sprite image.

5.106.3 Member Function Documentation

5.106.3.1 Clone()

```
UniquePtr< SpriteImage > mage::SpriteImage::Clone ( ) const
```

Clones this sprite image.

Returns

A pointer to the clone of this sprite image.

5.106.3.2 CloneImplementation()

```
UniquePtr< SpriteObject > mage::SpriteImage::CloneImplementation ( ) const [override], [private], [virtual]
```

Clones this sprite image.

Returns

A pointer to the clone of this sprite image.

Implements [mage::SpriteObject](#).

5.106.3.3 Draw()

```
void mage::SpriteImage::Draw ( SpriteBatch & sprite_batch ) const [virtual]
```

Draws this sprite image.

Parameters

| | | |
|----|---------------------|---|
| in | <i>sprite_batch</i> | A reference to the sprite batch used for rendering this sprite image. |
|----|---------------------|---|

Implements [mage::SpriteObject](#).

5.106.3.4 GetColor()

```
const Color mage::SpriteImage::GetColor ( ) const
```

Returns the color of this sprite image.

Returns

The color of this sprite image.

5.106.3.5 GetColorVector()

```
const XMVECTOR mage::SpriteImage::GetColorVector ( ) const [private]
```

Returns the color of this sprite image as XMVECTOR.

Returns

The color of this sprite image as XMVECTOR.

5.106.3.6 GetTexture()

```
SharedPtr< Texture > mage::SpriteImage::GetTexture ( ) const
```

Returns the texture of this sprite image.

Returns

A pointer to the texture of this sprite image.

5.106.3.7 operator=() [1/2]

```
SpriteImage& mage::SpriteImage::operator= (
    const SpriteImage & sprite_image ) [delete]
```

Copies the given sprite image to this sprite image.

Parameters

| | | |
|----|---------------------|--|
| in | <i>sprite_image</i> | A reference to the sprite image to copy. |
|----|---------------------|--|

Returns

A reference to the copy of the given sprite image (i.e. this sprite image).

5.106.3.8 operator=() [2/2]

```
SpriteImage& mage::SpriteImage::operator= (
    SpriteImage && sprite_image ) [delete]
```

Moves the given sprite image to this sprite image.

Parameters

| | | |
|----|---------------------|--|
| in | <i>sprite_image</i> | A reference to the sprite image to move. |
|----|---------------------|--|

Returns

A reference to the moved sprite image (i.e. this sprite image).

5.106.3.9 SetColor() [1/2]

```
void mage::SpriteImage::SetColor (
    const Color & color )
```

Sets the color of this sprite image to the given color.

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>color</i> | A reference to the color. |
|----|--------------|---------------------------|

5.106.3.10 SetColor() [2/2]

```
void mage::SpriteImage::SetColor (
    const XMVECTOR & color )
```

Sets the color of this sprite image to the given color.

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>color</i> | A reference to the color. |
|----|--------------|---------------------------|

5.106.3.11 SetTexture()

```
void mage::SpriteImage::SetTexture (
    SharedPtr< Texture > texture )
```

Sets the texture of this sprite image to the given texture.

Precondition

texture.get() is not equal to `nullptr`

Parameters

| | | |
|----|----------------|---------------------------|
| in | <i>texture</i> | A pointer to the texture. |
|----|----------------|---------------------------|

5.106.3.12 SetTextureRegion()

```
void mage::SpriteImage::SetTextureRegion (
    const RECT & texture_region )
```

Sets the texture region of this sprite image to the given texture region.

Parameters

| | | |
|----|-----------------------|------------------------------------|
| in | <i>texture_region</i> | A reference to the texture region. |
|----|-----------------------|------------------------------------|

5.106.4 Member Data Documentation

5.106.4.1 m_color

`Color` `mage::SpriteImage::m_color` [private]

The color of this sprite image.

5.106.4.2 m_texture

`SharedPtr< Texture >` `mage::SpriteImage::m_texture` [private]

A pointer to the texture of this sprite image.

5.106.4.3 m_texture_region

`UniquePtr< RECT >` `mage::SpriteImage::m_texture_region` [private]

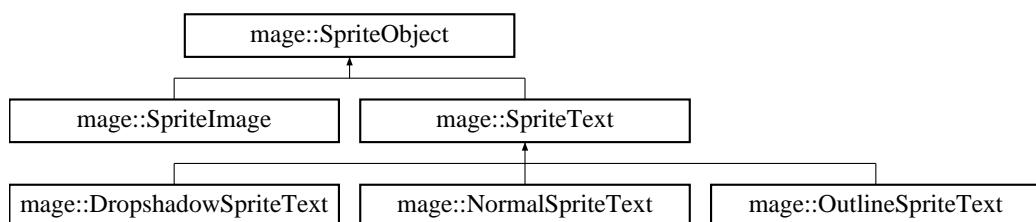
A pointer to the texture region of this sprite image.

If `nullptr`, the full texture region is considered.

5.107 mage::SpriteObject Class Reference

```
#include <sprite_object.hpp>
```

Inheritance diagram for `mage::SpriteObject`:



Public Member Functions

- virtual ~SpriteObject ()
- SpriteObject & operator= (const SpriteObject &sprite_object)=delete
- SpriteObject & operator= (SpriteObject &&sprite_object)=delete
- UniquePtr< SpriteObject > Clone () const
- virtual void Draw (SpriteBatch &sprite_batch) const =0
- bool IsActive () const
- bool IsPassive () const
- void MakeActive ()
- void MakePassive ()
- void SetActive (bool active)
- const string & GetName () const
- void SetName (const string &name)
- SpriteEffect GetSpriteEffects () const
- void SetSpriteEffects (SpriteEffect effects)
- SpriteTransform * GetTransform ()
- const SpriteTransform * GetTransform () const

Protected Member Functions

- SpriteObject (const string &name, SpriteEffect effects=SpriteEffect_None)
- SpriteObject (const SpriteObject &sprite_object)
- SpriteObject (SpriteObject &&sprite_object)

Private Member Functions

- virtual UniquePtr< SpriteObject > CloneImplementation () const =0

Private Attributes

- UniquePtr< SpriteTransform > m_transform
- bool m_active
- string m_name
- SpriteEffect m_effects

5.107.1 Detailed Description

A class of sprite objects.

5.107.2 Constructor & Destructor Documentation

5.107.2.1 ~SpriteObject()

```
mage::SpriteObject::~SpriteObject ( ) [virtual], [default]
```

Destruct this sprite object.

5.107.2.2 SpriteObject() [1/3]

```
mage::SpriteObject::SpriteObject (
    const string & name,
    SpriteEffect effects = SpriteEffect_None ) [explicit], [protected]
```

Constructs a sprite object.

Parameters

| | | |
|----|----------------|------------------------------|
| in | <i>name</i> | The name. |
| in | <i>effects</i> | The sprite effects to apply. |

5.107.2.3 SpriteObject() [2/3]

```
mage::SpriteObject::SpriteObject (
    const SpriteObject & sprite_object ) [protected]
```

Constructs a sprite object from the given sprite object.

Parameters

| | | |
|----|----------------------|---|
| in | <i>sprite_object</i> | A reference to the sprite object to copy. |
|----|----------------------|---|

5.107.2.4 SpriteObject() [3/3]

```
mage::SpriteObject::SpriteObject (
    SpriteObject && sprite_object ) [protected], [default]
```

Constructs a sprite object by moving the given sprite object.

Parameters

| | | |
|----|----------------------|---|
| in | <i>sprite_object</i> | A reference to the sprite object to move. |
|----|----------------------|---|

5.107.3 Member Function Documentation**5.107.3.1 Clone()**

```
UniquePtr< SpriteObject > mage::SpriteObject::Clone ( ) const
```

Clones this sprite object.

Returns

A pointer to the clone of this sprite object.

5.107.3.2 ClonImplementation()

```
virtual UniquePtr< SpriteObject > mage::SpriteObject::CloneImplementation ( ) const [private], [pure virtual]
```

Clones this sprite object.

Returns

A pointer to the clone of this sprite object.

Implemented in [mage::SpriteText](#), [mage::SpritelImage](#), [mage::DropshadowSpriteText](#), [mage::OutlineSpriteText](#), and [mage::NormalSpriteText](#).

5.107.3.3 Draw()

```
virtual void mage::SpriteObject::Draw (
    SpriteBatch & sprite_batch ) const [pure virtual]
```

Draws this sprite object.

Parameters

| | | |
|----|---------------------|--|
| in | <i>sprite_batch</i> | A reference to the sprite batch used for rendering this sprite object. |
|----|---------------------|--|

Implemented in [mage::SpriteImage](#), [mage::DropshadowSpriteText](#), [mage::OutlineSpriteText](#), [mage::NormalSpriteText](#), and [mage::SpriteText](#).

5.107.3.4 GetName()

```
const string& mage::SpriteObject::GetName () const
```

Returns the name of this sprite object.

Returns

A reference to the name of this sprite object.

5.107.3.5 GetSpriteEffects()

```
SpriteEffect mage::SpriteObject::GetSpriteEffects () const
```

Returns the sprite effects of this sprite object.

Returns

The sprite effects of this sprite object.

5.107.3.6 GetTransform() [1/2]

```
SpriteTransform* mage::SpriteObject::GetTransform ()
```

Returns the transform of this sprite object.

Returns

A pointer to the transform of this sprite object.

5.107.3.7 GetTransform() [2/2]

```
const SpriteTransform* mage::SpriteObject::GetTransform ( ) const
```

Returns the transform of this sprite object.

Returns

A pointer to the transform of this sprite object.

5.107.3.8 IsActive()

```
bool mage::SpriteObject::IsActive ( ) const
```

Checks whether this sprite object is active.

Returns

true if this sprite object is active. false otherwise (i.e. passive).

5.107.3.9 IsPassive()

```
bool mage::SpriteObject::IsPassive ( ) const
```

Checks whether this sprite object is passive.

Returns

true if this sprite object is passive. false otherwise (i.e. active).

5.107.3.10 MakeActive()

```
void mage::SpriteObject::MakeActive ( )
```

Makes this sprite object active.

5.107.3.11 MakePassive()

```
void mage::SpriteObject::MakePassive ( )
```

Makes this sprite object passive.

5.107.3.12 operator=() [1/2]

```
SpriteObject& mage::SpriteObject::operator= (
    const SpriteObject & sprite_object ) [delete]
```

Copies the given sprite object to this sprite object.

Parameters

| | | |
|----|----------------------|---|
| in | <i>sprite_object</i> | A reference to the sprite text to copy. |
|----|----------------------|---|

Returns

A reference to the copy of the given sprite object (i.e. this sprite object).

5.107.3.13 operator=() [2/2]

```
SpriteObject& mage::SpriteObject::operator= (
    SpriteObject && sprite_object ) [delete]
```

Moves the given sprite object to this sprite object.

Parameters

| | | |
|----|----------------------|---|
| in | <i>sprite_object</i> | A reference to the sprite object to move. |
|----|----------------------|---|

Returns

A reference to the moved sprite object (i.e. this sprite object).

5.107.3.14 SetActive()

```
void mage::SpriteObject::SetActive (
    bool active )
```

Sets this sprite object active flag to the given value.

Parameters

| | | |
|----|---------------|------------------|
| in | <i>active</i> | The active flag. |
|----|---------------|------------------|

5.107.3.15 SetName()

```
void mage::SpriteObject::SetName (
    const string & name )
```

Sets the name of this sprite object to the given name.

Parameters

| | | |
|----|-------------|--------------------------|
| in | <i>name</i> | A reference to the name. |
|----|-------------|--------------------------|

5.107.3.16 SetSpriteEffects()

```
void mage::SpriteObject::SetSpriteEffects (
    SpriteEffect effects )
```

Sets the sprite effects of this sprite object to the given sprite effects.

Parameters

| | | |
|----|----------------|---------------------|
| in | <i>effects</i> | The sprite effects. |
|----|----------------|---------------------|

5.107.4 Member Data Documentation

5.107.4.1 m_active

```
bool mage::SpriteObject::m_active [private]
```

A flag indicating whether this node is active or not (i.e. passive).

5.107.4.2 m_effects

```
SpriteEffect mage::SpriteObject::m_effects [private]
```

The sprite effects of this sprite object.

5.107.4.3 m_name

```
string mage::SpriteObject::m_name [private]
```

The name of this sprite object.

5.107.4.4 m_transform

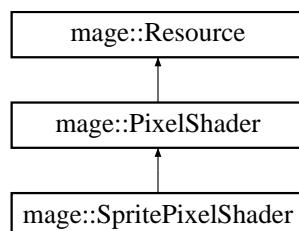
```
UniquePtr< SpriteTransform > mage::SpriteObject::m_transform [private]
```

A pointer to the sprite transform of this sprite object.

5.108 mage::SpritePixelShader Class Reference

```
#include <sprite_shader.hpp>
```

Inheritance diagram for mage::SpritePixelShader:



Public Member Functions

- `SpritePixelShader (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context)`
- `SpritePixelShader (const SpritePixelShader &pixel_shader)=delete`
- `SpritePixelShader (SpritePixelShader &&pixel_shader)`
- `virtual ~SpritePixelShader ()`
- `SpritePixelShader & operator= (const SpritePixelShader &pixel_shader)=delete`
- `SpritePixelShader & operator= (SpritePixelShader &&pixel_shader)=delete`
- `virtual void PrepareShading (ID3D11ShaderResourceView *texture) const override final`

Additional Inherited Members

5.108.1 Detailed Description

A class of sprite pixel shaders.

5.108.2 Constructor & Destructor Documentation

5.108.2.1 SpritePixelShader() [1/3]

```
mage::SpritePixelShader::SpritePixelShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context ) [explicit]
```

Constructs a sprite pixel shader.

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|----|-----------------------|----------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to initialize this sprite pixel shader. |
|---------------------------|--|

5.108.2.2 SpritePixelShader() [2/3]

```
mage::SpritePixelShader::SpritePixelShader (
    const SpritePixelShader & pixel_shader ) [delete]
```

Constructs a sprite pixel shader from the given sprite pixel shader.

Parameters

| | | |
|----|---------------------|---|
| in | <i>pixel_shader</i> | A reference to the sprite pixel shader to copy. |
|----|---------------------|---|

5.108.2.3 SpritePixelShader() [3/3]

```
mage::SpritePixelShader::SpritePixelShader (
    SpritePixelShader && pixel_shader ) [default]
```

Constructs a sprite pixel shader by moving the given sprite pixel shader.

Parameters

| | | |
|----|---------------------|---|
| in | <i>pixel_shader</i> | A reference to the sprite pixel shader to move. |
|----|---------------------|---|

5.108.2.4 ~SpritePixelShader()

```
mage::SpritePixelShader::~SpritePixelShader ( ) [virtual], [default]
```

Destructs this sprite pixel shader.

5.108.3 Member Function Documentation**5.108.3.1 operator=() [1/2]**

```
SpritePixelShader& mage::SpritePixelShader::operator= (
    const SpritePixelShader & pixel_shader ) [delete]
```

Copies the given sprite pixel shader to this sprite pixel shader.

Parameters

| | | |
|----|---------------------|---|
| in | <i>pixel_shader</i> | A reference to the sprite pixel shader to copy. |
|----|---------------------|---|

Returns

A reference to the copy of the given sprite pixel shader (i.e. this sprite pixel shader).

5.108.3.2 operator=() [2/2]

```
SpritePixelShader& mage::SpritePixelShader::operator= (
    SpritePixelShader && pixel_shader ) [delete]
```

Moves the given sprite pixel shader to this sprite pixel shader.

Parameters

| | | |
|-----------------|---------------------------|---|
| <code>in</code> | <code>pixel_shader</code> | A reference to the sprite pixel shader to move. |
|-----------------|---------------------------|---|

Returns

A reference to the moved sprite pixel shader (i.e. this sprite pixel shader).

5.108.3.3 PrepareShading()

```
void mage::SpritePixelShader::PrepareShading (
    ID3D11ShaderResourceView * texture ) const [final], [override], [virtual]
```

Prepares this sprite pixel shader for shading.

Parameters

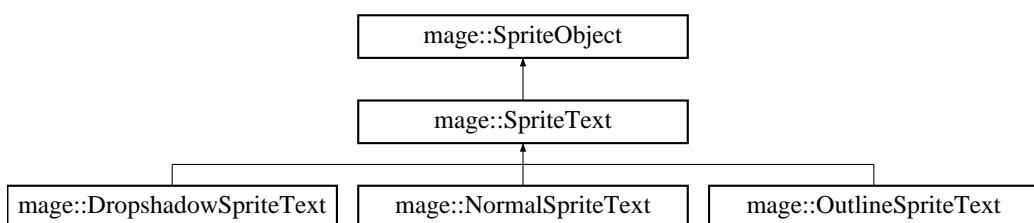
| | | |
|-----------------|----------------------|--|
| <code>in</code> | <code>texture</code> | A pointer to the texture shader resource view. |
|-----------------|----------------------|--|

Reimplemented from [mage::PixelShader](#).

5.109 mage::SpriteText Class Reference

```
#include <sprite_text.hpp>
```

Inheritance diagram for mage::SpriteText:

**Public Member Functions**

- virtual [`~SpriteText \(\)`](#)
- [`SpriteText & operator= \(const SpriteText &sprite_text\)=delete`](#)
- [`SpriteText & operator= \(SpriteText &&sprite_text\)=delete`](#)
- [`UniquePtr< SpriteText > Clone \(\) const`](#)
- virtual void [`Draw \(SpriteBatch &sprite_batch\) const =0`](#)
- [`SharedPtr< SpriteFont > GetFont \(\) const`](#)
- void [`SetFont \(SharedPtr< SpriteFont > font\)`](#)
- void [`ClearText \(\)`](#)
- const `wchar_t * c_str () const`
- const `wstring & GetText () const`

- const vector< [ColorString](#) > & [GetTextWithColors](#) () const
- void [SetText](#) (const wstring &text)
- void [SetText](#) (const wchar_t *text)
- void [SetText](#) (const [ColorString](#) &text)
- void [AppendText](#) (const wstring &text)
- void [AppendText](#) (const wchar_t *text)
- void [AppendText](#) (const [ColorString](#) &text)

Protected Member Functions

- [SpriteText](#) (const string &name, [SharedPtr< SpriteFont >](#) font, [SpriteEffect](#) effects=[SpriteEffect_None](#))
- [SpriteText](#) (const [SpriteText](#) &sprite_text)
- [SpriteText](#) ([SpriteText](#) &&sprite_text)
- const [SpriteFont](#) * [GetRawFont](#) () const
- template<typename ActionT >
void [ForEachColorString](#) (ActionT action)
- template<typename ActionT >
void [ForEachColorString](#) (ActionT action) const

Private Member Functions

- virtual [UniquePtr< SpriteObject >](#) [CloneImplementation](#) () const =0

Private Attributes

- wstring [m_text](#)
- vector< [ColorString](#) > [m_strings](#)
- [SharedPtr< SpriteFont >](#) [m_font](#)

5.109.1 Detailed Description

A class of sprite texts.

5.109.2 Constructor & Destructor Documentation

5.109.2.1 [~SpriteText\(\)](#)

```
mage::SpriteText::~SpriteText ( ) [virtual]
```

Destruct this sprite text.

5.109.2.2 [SpriteText\(\)](#) [1/3]

```
mage::SpriteText::SpriteText (
    const string & name,
    SharedPtr< SpriteFont > font,
    SpriteEffect effects = SpriteEffect\_None ) [explicit], [protected]
```

Constructs a sprite text.

Precondition

`font.get()` is not equal to `nullptr`.

Parameters

| | | |
|----|----------------|-------------------------------|
| in | <i>name</i> | The name. |
| in | <i>font</i> | A pointer to the sprite font. |
| in | <i>effects</i> | The sprite effects to apply. |

5.109.2.3 SpriteText() [2/3]

```
mage::SpriteText::SpriteText (
    const SpriteText & sprite_text ) [protected], [default]
```

Constructs a sprite text from the given sprite text.

Parameters

| | | |
|----|--------------------|---|
| in | <i>sprite_text</i> | A reference to the sprite text to copy. |
|----|--------------------|---|

5.109.2.4 SpriteText() [3/3]

```
mage::SpriteText::SpriteText (
    SpriteText && sprite_text ) [protected], [default]
```

Constructs a sprite text by moving the given sprite text.

Parameters

| | | |
|----|--------------------|---|
| in | <i>sprite_text</i> | A reference to the sprite text to move. |
|----|--------------------|---|

5.109.3 Member Function Documentation**5.109.3.1 AppendText() [1/3]**

```
void mage::SpriteText::AppendText (
    const wstring & text )
```

Appends the given text to the end of the text of this sprite text.

Parameters

| | | |
|----|-------------|--------------------------|
| in | <i>text</i> | A reference to the text. |
|----|-------------|--------------------------|

5.109.3.2 AppendText() [2/3]

```
void mage::SpriteText::AppendText (
    const wchar_t * text )
```

Appends the given text to the end of the text of this sprite text.

Precondition

text is not equal to `nullptr`.

Parameters

| | | |
|----|-------------|------------------------|
| in | <i>text</i> | A pointer to the text. |
|----|-------------|------------------------|

5.109.3.3 AppendText() [3/3]

```
void mage::SpriteText::AppendText ( const ColorString & text )
```

Appends the given text to the end of the text of this sprite text.

Parameters

| | | |
|----|-------------|--------------------------|
| in | <i>text</i> | A reference to the text. |
|----|-------------|--------------------------|

5.109.3.4 c_str()

```
const wchar_t* mage::SpriteText::c_str ( ) const
```

Returns the text of this sprite text.

Returns

A pointer to the text of this sprite text.

5.109.3.5 ClearText()

```
void mage::SpriteText::ClearText ( )
```

Clears the text of this sprite text.

5.109.3.6 Clone()

```
UniquePtr< SpriteText > mage::SpriteText::Clone ( ) const
```

Clones this sprite text.

Returns

A pointer to the clone of this sprite text.

5.109.3.7 CloneImplementation()

```
virtual UniquePtr< SpriteObject > mage::SpriteText::CloneImplementation( ) const [private],  
[pure virtual]
```

Clones this sprite text.

Returns

A pointer to the clone of this sprite text.

Implements [mage::SpriteObject](#).

Implemented in [mage::DropshadowSpriteText](#), [mage::OutlineSpriteText](#), and [mage::NormalSpriteText](#).

5.109.3.8 Draw()

```
virtual void mage::SpriteText::Draw(   
    SpriteBatch & sprite_batch ) const [pure virtual]
```

Draws this sprite text.

Parameters

| | | |
|----|---------------------|--|
| in | <i>sprite_batch</i> | A reference to the sprite batch used for rendering this sprite text. |
|----|---------------------|--|

Implements [mage::SpriteObject](#).

Implemented in [mage::DropshadowSpriteText](#), [mage::OutlineSpriteText](#), and [mage::NormalSpriteText](#).

5.109.3.9 ForEachColorString() [1/2]

```
template<typename ActionT >  
void mage::SpriteText::ForEachColorString(   
    ActionT action ) [protected]
```

Traverses all color strings of this sprite text.

Template Parameters

| | |
|---------|---|
| ActionT | An action to perform on all color strings of this sprite text. The action must accept ColorString & values. |
|---------|---|

5.109.3.10 ForEachColorString() [2/2]

```
template<typename ActionT >  
void mage::SpriteText::ForEachColorString(   
    ActionT action ) const [protected]
```

Traverses all color strings of this sprite text.

Template Parameters

| | |
|----------------------|---|
| <code>ActionT</code> | An action to perform on color strings of this sprite text. The action must accept <code>const ColorString&</code> values. |
|----------------------|---|

5.109.3.11 GetFont()

```
SharedPtr< SpriteFont > mage::SpriteText::GetFont () const
```

Returns the font of this sprite text.

Returns

A pointer to the font of this sprite text.

5.109.3.12 GetRawFont()

```
const SpriteFont* mage::SpriteText::GetRawFont () const [protected]
```

Returns the font of this sprite text.

Returns

A pointer to the font of this sprite text.

5.109.3.13 GetText()

```
const wstring& mage::SpriteText::GetText () const
```

Returns the text of this sprite text.

Returns

A reference to the text of this sprite text.

5.109.3.14 GetTextWithColors()

```
const vector< ColorString >& mage::SpriteText::GetTextWithColors () const
```

Returns the text of this sprite text with colors.

Returns

A reference to a vector containing the color strings of this sprite text.

5.109.3.15 operator=() [1/2]

```
SpriteText& mage::SpriteText::operator= (
    const SpriteText & sprite_text ) [delete]
```

Copies the given sprite text to this sprite text.

Parameters

| | | |
|----|--------------------|---|
| in | <i>sprite_text</i> | A reference to the sprite text to copy. |
|----|--------------------|---|

Returns

A reference to the copy of the given sprite text (i.e. this sprite text).

5.109.3.16 operator=() [2/2]

```
SpriteText& mage::SpriteText::operator= (
    SpriteText && sprite_text ) [delete]
```

Moves the given sprite text to this sprite text.

Parameters

| | | |
|----|--------------------|---|
| in | <i>sprite_text</i> | A reference to the sprite text to move. |
|----|--------------------|---|

Returns

A reference to the moved sprite text (i.e. this sprite text).

5.109.3.17 SetFont()

```
void mage::SpriteText::SetFont (
    SharedPtr< SpriteFont > font )
```

Sets the font of this sprite text to the given font.

Precondition

font.get() is not equal to `nullptr`.

Parameters

| | | |
|----|-------------|--|
| in | <i>font</i> | A pointer to the font of this sprite text. |
|----|-------------|--|

5.109.3.18 SetText() [1/3]

```
void mage::SpriteText::SetText (
    const wstring & text )
```

Sets the text of this sprite text to the given text.

Parameters

| | | |
|----|-------------|--------------------------|
| in | <i>text</i> | A reference to the text. |
|----|-------------|--------------------------|

5.109.3.19 SetText() [2/3]

```
void mage::SpriteText::SetText (
    const wchar_t * text )
```

Sets the text of this sprite text to the given text.

Precondition

text is not equal to nullptr.

Parameters

| | | |
|----|-------------|------------------------|
| in | <i>text</i> | A pointer to the text. |
|----|-------------|------------------------|

5.109.3.20 SetText() [3/3]

```
void mage::SpriteText::SetText (
    const ColorString & text )
```

Sets the text of this sprite text to the given text.

Parameters

| | | |
|----|-------------|--------------------------|
| in | <i>text</i> | A reference to the text. |
|----|-------------|--------------------------|

5.109.4 Member Data Documentation**5.109.4.1 m_font**

```
SharedPtr< SpriteFont > mage::SpriteText::m_font [private]
```

A pointer to the sprite font of this sprite text.

5.109.4.2 m_strings

```
vector< ColorString > mage::SpriteText::m_strings [private]
```

A vector with the color strings of this sprite text.

5.109.4.3 m_text

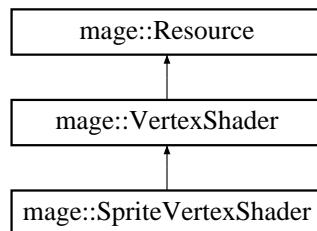
```
wstring mage::SpriteText::m_text [private]
```

The text of this sprite text.

5.110 mage::SpriteVertexShader Class Reference

```
#include <sprite_shader.hpp>
```

Inheritance diagram for mage::SpriteVertexShader:



Public Member Functions

- [SpriteVertexShader \(ID3D11Device2 *device, ID3D11DeviceContext2 *device_context\)](#)
- [SpriteVertexShader \(const SpriteVertexShader &vertex_shader\)=delete](#)
- [SpriteVertexShader \(SpriteVertexShader &&vertex_shader\)](#)
- [virtual ~SpriteVertexShader \(\)](#)
- [SpriteVertexShader & operator= \(const SpriteVertexShader &vertex_shader\)=delete](#)
- [SpriteVertexShader & operator= \(SpriteVertexShader &&vertex_shader\)=delete](#)
- [virtual void PrepareShading \(ID3D11Buffer *transform\) const override final](#)

Additional Inherited Members

5.110.1 Detailed Description

A class of sprite vertex shaders.

5.110.2 Constructor & Destructor Documentation

5.110.2.1 SpriteVertexShader() [1/3]

```
mage::SpriteVertexShader::SpriteVertexShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context ) [explicit]
```

Constructs a sprite vertex shader.

Precondition

- device* is not equal to `nullptr`.
- device_context* is not equal to `nullptr`.

Parameters

| | | |
|-----------------|-----------------------------|----------------------------------|
| <code>in</code> | <code>device</code> | A pointer to the device. |
| <code>in</code> | <code>device_context</code> | A pointer to the device context. |

Exceptions

| | |
|---------------------------------|---|
| <code>FormattedException</code> | Failed to initialize this sprite vertex shader. |
|---------------------------------|---|

5.110.2.2 SpriteVertexShader() [2/3]

```
mage::SpriteVertexShader::SpriteVertexShader (
    const SpriteVertexShader & vertex_shader ) [delete]
```

Constructs a sprite vertex shader from the given sprite vertex shader.

Parameters

| | | |
|-----------------|----------------------------|--|
| <code>in</code> | <code>vertex_shader</code> | A reference to the sprite vertex shader to copy. |
|-----------------|----------------------------|--|

5.110.2.3 SpriteVertexShader() [3/3]

```
mage::SpriteVertexShader::SpriteVertexShader (
    SpriteVertexShader && vertex_shader ) [default]
```

Constructs a sprite vertex shader by moving the given sprite vertex shader.

Parameters

| | | |
|-----------------|----------------------------|--|
| <code>in</code> | <code>vertex_shader</code> | A reference to the sprite vertex shader to move. |
|-----------------|----------------------------|--|

5.110.2.4 ~SpriteVertexShader()

```
mage::SpriteVertexShader::~SpriteVertexShader ( ) [virtual], [default]
```

Destructs this sprite vertex shader.

5.110.3 Member Function Documentation**5.110.3.1 operator=()** [1/2]

```
SpriteVertexShader& mage::SpriteVertexShader::operator= (
    const SpriteVertexShader & vertex_shader ) [delete]
```

Copies the given sprite vertex shader to this sprite vertex shader.

Parameters

| | | |
|-----------------|----------------------------|--|
| <code>in</code> | <code>vertex_shader</code> | A reference to the sprite vertex shader to copy. |
|-----------------|----------------------------|--|

Returns

A reference to the copy of the given sprite vertex shader (i.e. this sprite vertex shader).

5.110.3.2 operator=() [2/2]

```
SpriteVertexShader& mage::SpriteVertexShader::operator= (
    SpriteVertexShader && vertex_shader ) [delete]
```

Copies the given sprite vertex shader to this sprite vertex shader.

Parameters

| | | |
|-----------------|----------------------------|--|
| <code>in</code> | <code>vertex_shader</code> | A reference to the sprite vertex shader to copy. |
|-----------------|----------------------------|--|

Returns

A reference to the moved sprite vertex shader (i.e. this sprite vertex shader).

5.110.3.3 PrepareShading()

```
void mage::SpriteVertexShader::PrepareShading (
    ID3D11Buffer * transform ) const [final], [override], [virtual]
```

Prepares this sprite vertex shader for shading.

Precondition

`transform` is not equal to `nullptr`.

Parameters

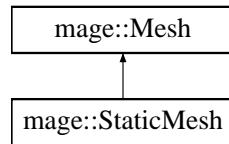
| | | |
|-----------------|------------------------|------------------------------------|
| <code>in</code> | <code>transform</code> | A pointer to the transform buffer. |
|-----------------|------------------------|------------------------------------|

Reimplemented from [mage::VertexShader](#).

5.111 mage::StaticMesh Class Reference

```
#include <static_mesh.hpp>
```

Inheritance diagram for `mage::StaticMesh`:



Public Member Functions

- template<typename VertexT >
`StaticMesh (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const VertexT *vertices, size_t nb_vertices, const uint32_t *indices, size_t nb_indices)`
- template<typename VertexT >
`StaticMesh (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const vector< VertexT > &vertices, const vector< uint32_t > &indices)`
- `StaticMesh (const StaticMesh &static_mesh)=delete`
- `StaticMesh (StaticMesh &&static_mesh)`
- virtual `~StaticMesh ()`
- `StaticMesh & operator= (const StaticMesh &static_mesh)=delete`
- `StaticMesh & operator= (StaticMesh &&static_mesh)=delete`

Private Member Functions

- template<typename VertexT >
`void SetupVertexBuffer (const VertexT *vertices, size_t nb_vertices)`
- `void SetupIndexBuffer (const uint32_t *indices, size_t nb_indices)`

Additional Inherited Members

5.111.1 Detailed Description

A class of indexed static meshes.

5.111.2 Constructor & Destructor Documentation

5.111.2.1 StaticMesh() [1/4]

```

template<typename VertexT >
mage::StaticMesh::StaticMesh (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const VertexT * vertices,
    size_t nb_vertices,
    const uint32_t * indices,
    size_t nb_indices )  [explicit]
  
```

Constructs a static mesh.

Precondition

- `device` is not equal to `nullptr`.
- `device_context` is not equal to `nullptr`.
- `vertices` points to an array of at least `nb_vertices` vertices.
- `nb_vertices` must be greater than zero.
- `indices` points to an array of at least `nb_indices` indices.
- `nb_indices` must be greater than zero.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

Parameters

| | | |
|----|-----------------------|------------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>vertices</i> | A pointer to an array of vertices. |
| in | <i>nb_vertices</i> | The number of vertices. |
| in | <i>indices</i> | A pointer to an array of indices. |
| in | <i>nb_indices</i> | The number of indices. |

5.111.2.2 StaticMesh() [2/4]

```
template<typename VertexT >
image::StaticMesh::StaticMesh (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const vector< VertexT > & vertices,
    const vector< uint32_t > & indices ) [explicit]
```

Constructs a static mesh.

Precondition

- device* is not equal to `nullptr`.
- device_context* is not equal to `nullptr`.
- The number of vertices must be greater than zero.
- The number of indices must be greater than zero.

Template Parameters

| | |
|----------------|------------------|
| <i>VertexT</i> | The vertex type. |
|----------------|------------------|

Parameters

| | | |
|----|-----------------------|--------------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>vertices</i> | A reference to a vector of vertices. |
| in | <i>indices</i> | A reference to a vector of indices. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to setup the vertex buffer of the static mesh. |
| <i>FormattedException</i> | Failed to setup the index buffer of the static mesh. |

5.111.2.3 StaticMesh() [3/4]

```
mage::StaticMesh::StaticMesh (
    const StaticMesh & static_mesh ) [delete]
```

Constructs a static mesh from the given static mesh.

Parameters

| | | |
|----|-------------|---|
| in | static_mesh | A reference to the static mesh to copy. |
|----|-------------|---|

5.111.2.4 StaticMesh() [4/4]

```
mage::StaticMesh::StaticMesh (
    StaticMesh && static_mesh ) [default]
```

Constructs a static mesh by moving the given static mesh.

Parameters

| | | |
|----|-------------|---|
| in | static_mesh | A reference to the static mesh to move. |
|----|-------------|---|

5.111.2.5 ~StaticMesh()

```
mage::StaticMesh::~StaticMesh ( ) [virtual], [default]
```

Destructs this static mesh.

5.111.3 Member Function Documentation

5.111.3.1 operator=() [1/2]

```
StaticMesh& mage::StaticMesh::operator= (
    const StaticMesh & static_mesh ) [delete]
```

Copies the given static mesh to this static mesh.

Parameters

| | | |
|----|-------------|---|
| in | static_mesh | A reference to the static mesh to copy. |
|----|-------------|---|

Returns

A reference to the copy of the given static mesh (i.e. this static mesh).

5.111.3.2 operator=() [2/2]

```
StaticMesh& mage::StaticMesh::operator= (
    StaticMesh && static_mesh ) [delete]
```

Moves the given static mesh to this static mesh.

Parameters

| | | |
|----|--------------------|---|
| in | <i>static_mesh</i> | A reference to the static mesh to move. |
|----|--------------------|---|

Returns

A reference to the moved static mesh (i.e. this static mesh).

5.111.3.3 SetupIndexBuffer()

```
void mage::StaticMesh::SetupIndexBuffer (
    const uint32_t * indices,
    size_t nb_indices ) [private]
```

Sets up the index buffer of this static mesh.

Precondition

indices points to an array of at least *nb_indices* indices.
nb_indices must be greater than zero.

Parameters

| | | |
|----|-------------------|-----------------------------------|
| in | <i>indices</i> | A pointer to an array of indices. |
| in | <i>nb_indices</i> | The number of indices. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to setup the index buffer of this static mesh. |
|---------------------------|---|

5.111.3.4 SetupVertexBuffer()

```
template<typename VertexT >
void mage::StaticMesh::SetupVertexBuffer (
    const VertexT * vertices,
    size_t nb_vertices ) [private]
```

Sets up the vertex buffer of this static mesh.

Precondition

vertices points to an array of at least *nb_vertices* vertices.
nb_vertices must be greater than zero.

Template Parameters

| | |
|----------------------|------------------|
| <code>VertexT</code> | The vertex type. |
|----------------------|------------------|

Parameters

| | | |
|-----------------|--------------------------|------------------------------------|
| <code>in</code> | <code>vertices</code> | A pointer to an array of vertices. |
| <code>in</code> | <code>nb_vertices</code> | The number of vertices. |

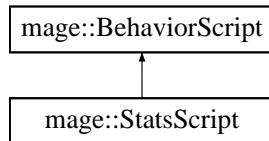
Exceptions

| | |
|---------------------------------|--|
| <code>FormattedException</code> | Failed to setup the vertex buffer of this static mesh. |
|---------------------------------|--|

5.112 mage::StatsScript Class Reference

```
#include <stats_script.hpp>
```

Inheritance diagram for mage::StatsScript:

**Public Member Functions**

- `StatsScript (SharedPtr< SpriteText > text)`
- `StatsScript (const StatsScript &script)=delete`
- `StatsScript (StatsScript &&script)`
- `virtual ~StatsScript ()`
- `StatsScript & operator= (const StatsScript &script)=delete`
- `StatsScript & operator= (StatsScript &&script)=delete`
- `virtual void Update (double delta_time) override`
- `SpriteText * GetTransform ()`
- `const SpriteText * GetTransform () const`

Static Public Attributes

- `static const double resource_fetch_period = 1.0`

Private Attributes

- `double m_accumulated_time`
- `uint32_t m_accumulated_nb_frames`
- `uint32_t m_last_frames_per_second`
- `double m_last_cpu_usage`
- `uint32_t m_last_ram_usage`
- `UniquePtr< CPUMonitor > m_monitor`
- `SharedPtr< SpriteText > m_text`

Additional Inherited Members

5.112.1 Constructor & Destructor Documentation

5.112.1.1 StatsScript() [1/3]

```
mage::StatsScript::StatsScript (
    SharedPtr< SpriteText > text )  [explicit]
```

5.112.1.2 StatsScript() [2/3]

```
mage::StatsScript::StatsScript (
    const StatsScript & script )  [delete]
```

5.112.1.3 StatsScript() [3/3]

```
mage::StatsScript::StatsScript (
    StatsScript && script )  [default]
```

5.112.1.4 ~StatsScript()

```
mage::StatsScript::~StatsScript ( )  [virtual], [default]
```

5.112.2 Member Function Documentation

5.112.2.1 GetTransform() [1/2]

```
SpriteText* mage::StatsScript::GetTransform ( )
```

5.112.2.2 GetTransform() [2/2]

```
const SpriteText* mage::StatsScript::GetTransform ( ) const
```

5.112.2.3 operator=() [1/2]

```
StatsScript& mage::StatsScript::operator= (
    const StatsScript & script )  [delete]
```

5.112.2.4 operator=() [2/2]

```
StatsScript& mage::StatsScript::operator= (
    StatsScript && script )  [delete]
```

5.112.2.5 Update()

```
void mage::StatsScript::Update (
    double delta_time )  [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.112.3 Member Data Documentation

5.112.3.1 m_accumulated_nb_frames

```
uint32_t mage::StatsScript::m_accumulated_nb_frames [private]
```

5.112.3.2 m_accumulated_time

```
double mage::StatsScript::m_accumulated_time [private]
```

5.112.3.3 m_last_cpu_usage

```
double mage::StatsScript::m_last_cpu_usage [private]
```

5.112.3.4 m_last_frames_per_second

```
uint32_t mage::StatsScript::m_last_frames_per_second [private]
```

5.112.3.5 m_last_ram_usage

```
uint32_t mage::StatsScript::m_last_ram_usage [private]
```

5.112.3.6 m_monitor

```
UniquePtr< CPUMonitor > mage::StatsScript::m_monitor [private]
```

5.112.3.7 m_text

```
SharedPtr< SpriteText > mage::StatsScript::m_text [private]
```

5.112.3.8 resource_fetch_period

```
const double mage::StatsScript::resource_fetch_period = 1.0 [static]
```

5.113 mage::StructuredBuffer< DataT > Struct Template Reference

```
#include <structured_buffer.hpp>
```

Public Member Functions

- [StructuredBuffer](#) (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, size_t nb_initial_data←_elements)
- [StructuredBuffer](#) (const [StructuredBuffer](#) &buffer)=delete
- [StructuredBuffer](#) ([StructuredBuffer](#) &&buffer)=default
- [~StructuredBuffer](#) ()=default
- [StructuredBuffer](#) & [operator=](#) (const [StructuredBuffer](#) &buffer)=delete
- [StructuredBuffer](#) & [operator=](#) ([StructuredBuffer](#) &&buffer)=delete
- void [UpdateData](#) (const vector< DataT > &data) const
- ID3D11ShaderResourceView * [Get](#) () const
- ID3D11ShaderResourceView *const * [GetAddressOf](#) () const
- ID3D11ShaderResourceView ** [GetAddressOf](#) ()

Private Member Functions

- void [SetupStructuredBuffer](#) (size_t nb_data_elements) const

Private Attributes

- ID3D11Device2 *const [m_device](#)
- ID3D11DeviceContext2 *const [m_device_context](#)
- ComPtr< ID3D11Buffer > [m_buffer](#)
- size_t [m_nb_data_elements](#)
- ComPtr< ID3D11ShaderResourceView > [m_buffer_srv](#)

5.113.1 Detailed Description

```
template<typename DataT>
struct mage::StructuredBuffer< DataT >
```

A class of structured buffers (for binding arrays of buffers to the rendering pipeline).

Template Parameters

| | |
|--------------|----------------|
| <i>DataT</i> | The data type. |
|--------------|----------------|

5.113.2 Constructor & Destructor Documentation

5.113.2.1 StructuredBuffer() [1/3]

```
template<typename DataT>
mage::StructuredBuffer< DataT >::StructuredBuffer (
```

```
ID3D11Device2 * device,
ID3D11DeviceContext2 * device_context,
size_t nb_initial_data_elements ) [explicit]
```

Constructs a structured buffer.

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.

Parameters

| | | |
|----|---------------------------------|---|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>nb_initial_data_elements</i> | The initial number of slots for storing data elements to provide. |

5.113.2.2 StructuredBuffer() [2/3]

```
template<typename DataT>
mage::StructuredBuffer< DataT >::StructuredBuffer (
    const StructuredBuffer< DataT > & buffer ) [delete]
```

Constructs a structured buffer from the given structured buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the structured buffer to copy. |
|----|---------------|---|

5.113.2.3 StructuredBuffer() [3/3]

```
template<typename DataT>
mage::StructuredBuffer< DataT >::StructuredBuffer (
    StructuredBuffer< DataT > && buffer ) [default]
```

Constructs a structured buffer by moving the given structured buffer.

Parameters

| | | |
|----|---------------|---|
| in | <i>buffer</i> | A reference to the structured buffer to move. |
|----|---------------|---|

5.113.2.4 ~StructuredBuffer()

```
template<typename DataT>
mage::StructuredBuffer< DataT >::~StructuredBuffer ( ) [default]
```

Destructs this structured buffer.

5.113.3 Member Function Documentation

5.113.3.1 Get()

```
template<typename DataT>
ID3D11ShaderResourceView* mage::StructuredBuffer< DataT >::Get( ) const
```

Returns the shader resource view of this structured buffer.

Returns

A pointer to the shader resource view of this structured buffer.

5.113.3.2 GetAddressOf() [1/2]

```
template<typename DataT>
ID3D11ShaderResourceView* const* mage::StructuredBuffer< DataT >::GetAddressOf( ) const
```

Returns the address of the shader resource view of this structured buffer.

Returns

A pointer to a pointer to the shader resource view of this structured buffer.

5.113.3.3 GetAddressOf() [2/2]

```
template<typename DataT>
ID3D11ShaderResourceView** mage::StructuredBuffer< DataT >::GetAddressOf( )
```

Returns the address of the shader resource view of this structured buffer.

Returns

A pointer to a pointer to the shader resource view of this structured buffer.

5.113.3.4 operator=() [1/2]

```
template<typename DataT>
StructuredBuffer& mage::StructuredBuffer< DataT >::operator= (
    const StructuredBuffer< DataT > & buffer ) [delete]
```

Copies the given structured buffer to this structured buffer.

Parameters

| | | |
|----|--------|---|
| in | buffer | A reference to the structured buffer to copy. |
|----|--------|---|

Returns

A reference to the copy of the given structured buffer (i.e. this structured buffer).

5.113.3.5 operator=() [2/2]

```
template<typename DataT>
StructuredBuffer& mage::StructuredBuffer< DataT >::operator= (
    StructuredBuffer< DataT > && buffer ) [delete]
```

Moves the given structured buffer to this structured buffer.

Parameters

| | | |
|-----------------|---------------------|---|
| <code>in</code> | <code>buffer</code> | A reference to the structured buffer to move. |
|-----------------|---------------------|---|

Returns

A reference to the copy of the given structured buffer (i.e. this structured buffer).

5.113.3.6 SetupStructuredBuffer()

```
template<typename DataT>
void mage::StructuredBuffer< DataT >::SetupStructuredBuffer (
    size_t nb_data_elements ) const [private]
```

Sets up the resource buffer and shader resource view of this structured buffer.

Parameters

| | | |
|-----------------|-------------------------------|---|
| <code>in</code> | <code>nb_data_elements</code> | The number of slots for storing data elements to provide. |
|-----------------|-------------------------------|---|

Exceptions

| | |
|---------------------------------|---|
| <code>FormattedException</code> | Failed to setup this structured buffer. |
|---------------------------------|---|

5.113.3.7 UpdateData()

```
template<typename DataT>
void mage::StructuredBuffer< DataT >::UpdateData (
    const vector< DataT > & data ) const
```

Updates the data of structured buffer with the given data.

Parameters

| | | |
|-----------------|-------------------|---|
| <code>in</code> | <code>data</code> | A reference to a vector with the data elements. |
|-----------------|-------------------|---|

5.113.4 Member Data Documentation

5.113.4.1 m_buffer

```
template<typename DataT>
ComPtr< ID3D11Buffer > mage::StructuredBuffer< DataT >::m_buffer [mutable], [private]
```

A pointer to the buffer resource of this structured buffer.

5.113.4.2 m_buffer_srv

```
template<typename DataT>
ComPtr< ID3D11ShaderResourceView > mage::StructuredBuffer< DataT >::m_buffer_srv [mutable], [private]
```

A pointer to the shader resource view of this structured buffer.

5.113.4.3 m_device

```
template<typename DataT>
ID3D11Device2* const mage::StructuredBuffer< DataT >::m_device [private]
```

A pointer to the device of this structured buffer.

5.113.4.4 m_device_context

```
template<typename DataT>
ID3D11DeviceContext2* const mage::StructuredBuffer< DataT >::m_device_context [private]
```

A pointer to the device context of this structured buffer.

5.113.4.5 m_nb_data_elements

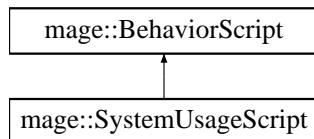
```
template<typename DataT>
size_t mage::StructuredBuffer< DataT >::m_nb_data_elements [mutable], [private]
```

The number of slots available for storing data elements in the current buffer resource of this structured buffer.

5.114 mage::SystemUsageScript Class Reference

```
#include <system_usage_script.hpp>
```

Inheritance diagram for mage::SystemUsageScript:



Public Member Functions

- `SystemUsageScript (SharedPtr< SpriteText > text)`
- `SystemUsageScript (const SystemUsageScript &script)=delete`
- `SystemUsageScript (SystemUsageScript &&script)`
- `virtual ~SystemUsageScript ()`
- `SystemUsageScript & operator= (const SystemUsageScript &script)=delete`
- `SystemUsageScript & operator= (SystemUsageScript &&script)=delete`
- `virtual void Update (double delta_time) override`
- `SpriteText * GetTransform ()`
- `const SpriteText * GetTransform () const`

Static Public Attributes

- `static const double resource_fetch_period = 1.00`

Private Attributes

- `double m_accumulated_time`
- `double m_last_cpu_usage`
- `uint32_t m_last_ram_usage`
- `UniquePtr< CPUMonitor > m_monitor`
- `SharedPtr< SpriteText > m_text`

Additional Inherited Members

5.114.1 Constructor & Destructor Documentation

5.114.1.1 SystemUsageScript() [1/3]

```
mage::SystemUsageScript::SystemUsageScript (
    SharedPtr< SpriteText > text ) [explicit]
```

5.114.1.2 SystemUsageScript() [2/3]

```
mage::SystemUsageScript::SystemUsageScript (
    const SystemUsageScript & script ) [delete]
```

5.114.1.3 SystemUsageScript() [3/3]

```
mage::SystemUsageScript::SystemUsageScript (
    SystemUsageScript && script ) [default]
```

5.114.1.4 ~SystemUsageScript()

```
mage::SystemUsageScript::~SystemUsageScript ( ) [virtual], [default]
```

5.114.2 Member Function Documentation

5.114.2.1 GetTransform() [1/2]

```
SpriteText* mage::SystemUsageScript::GetTransform ( )
```

5.114.2.2 GetTransform() [2/2]

```
const SpriteText* mage::SystemUsageScript::GetTransform ( ) const
```

5.114.2.3 operator=() [1/2]

```
SystemUsageScript& mage::SystemUsageScript::operator= (
    const SystemUsageScript & script ) [delete]
```

5.114.2.4 operator=() [2/2]

```
SystemUsageScript& mage::SystemUsageScript::operator= (
    SystemUsageScript && script ) [delete]
```

5.114.2.5 Update()

```
void mage::SystemUsageScript::Update (
    double delta_time ) [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.114.3 Member Data Documentation

5.114.3.1 m_accumulated_time

```
double mage::SystemUsageScript::m_accumulated_time [private]
```

5.114.3.2 m_last_cpu_usage

```
double mage::SystemUsageScript::m_last_cpu_usage [private]
```

5.114.3.3 m_last_ram_usage

```
uint32_t mage::SystemUsageScript::m_last_ram_usage [private]
```

5.114.3.4 m_monitor

```
UniquePtr< CPUMonitor > mage::SystemUsageScript::m_monitor [private]
```

5.114.3.5 m_text

```
SharedPtr< SpriteText > mage::SystemUsageScript::m_text [private]
```

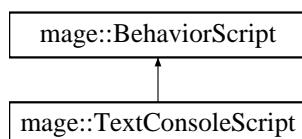
5.114.3.6 resource_fetch_period

```
const double mage::SystemUsageScript::resource_fetch_period = 1.00 [static]
```

5.115 mage::TextConsoleScript Class Reference

```
#include <text_console_script.hpp>
```

Inheritance diagram for mage::TextConsoleScript:



Public Member Functions

- `TextConsoleScript (SharedPtr< SpriteText > text, uint32_t nb_rows, uint32_t nb_columns)`
- `TextConsoleScript (const TextConsoleScript &script)=delete`
- `TextConsoleScript (TextConsoleScript &&script)`
- `virtual ~TextConsoleScript ()`
- `TextConsoleScript & operator= (const TextConsoleScript &script)=delete`
- `TextConsoleScript & operator= (TextConsoleScript &&script)=delete`
- `virtual void Update (double delta_time) override`
- `void Clear ()`
- `void Write (const wchar_t *str)`
- `void WriteLine (const wchar_t *str)`
- `void Format (const wchar_t *format,...)`
- `SpriteText * GetTransform ()`
- `const SpriteText * GetTransform () const`

Private Member Functions

- void `ProcessString` (const wchar_t *str)
- void `IncrementRow` ()
- void `SetCharacter` (wchar_t character, uint32_t row, uint32_t column)

Private Attributes

- `SharedPtr< SpriteText > m_text`
- const uint32_t `m_nb_rows`
- const uint32_t `m_nb_columns`
- uint32_t `m_current_column`
- uint32_t `m_current_row`
- `UniquePtr< wchar_t[] > m_buffer`
- vector< wchar_t > `m_temp_buffer`
- `Mutex m_mutex`

Additional Inherited Members

5.115.1 Constructor & Destructor Documentation

5.115.1.1 `TextConsoleScript()` [1/3]

```
mage::TextConsoleScript::TextConsoleScript (
    SharedPtr< SpriteText > text,
    uint32_t nb_rows,
    uint32_t nb_columns )  [explicit]
```

5.115.1.2 `TextConsoleScript()` [2/3]

```
mage::TextConsoleScript::TextConsoleScript (
    const TextConsoleScript & script )  [delete]
```

5.115.1.3 `TextConsoleScript()` [3/3]

```
mage::TextConsoleScript::TextConsoleScript (
    TextConsoleScript && script )  [default]
```

5.115.1.4 `~TextConsoleScript()`

```
mage::TextConsoleScript::~TextConsoleScript ( )  [virtual], [default]
```

5.115.2 Member Function Documentation

5.115.2.1 `Clear()`

```
void mage::TextConsoleScript::Clear ( )
```

5.115.2.2 Format()

```
void mage::TextConsoleScript::Format (
    const wchar_t * format,
    ...
)
```

5.115.2.3 GetTransform() [1/2]

```
SpriteText* mage::TextConsoleScript::GetTransform ( )
```

5.115.2.4 GetTransform() [2/2]

```
const SpriteText* mage::TextConsoleScript::GetTransform ( ) const
```

5.115.2.5 IncrementRow()

```
void mage::TextConsoleScript::IncrementRow ( ) [private]
```

5.115.2.6 operator=() [1/2]

```
TextConsoleScript& mage::TextConsoleScript::operator= (
    const TextConsoleScript & script ) [delete]
```

5.115.2.7 operator=() [2/2]

```
TextConsoleScript& mage::TextConsoleScript::operator= (
    TextConsoleScript && script ) [delete]
```

5.115.2.8 ProcessString()

```
void mage::TextConsoleScript::ProcessString (
    const wchar_t * str ) [private]
```

5.115.2.9 SetCharacter()

```
void mage::TextConsoleScript::SetCharacter (
    wchar_t character,
    uint32_t row,
    uint32_t column ) [private]
```

5.115.2.10 Update()

```
void mage::TextConsoleScript::Update (
    double delta_time ) [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.115.2.11 Write()

```
void mage::TextConsoleScript::Write (
    const wchar_t * str )
```

5.115.2.12 WriteLine()

```
void mage::TextConsoleScript::WriteLine (
    const wchar_t * str )
```

5.115.3 Member Data Documentation**5.115.3.1 m_buffer**

```
UniquePtr< wchar_t[] > mage::TextConsoleScript::m_buffer [private]
```

5.115.3.2 m_current_column

```
uint32_t mage::TextConsoleScript::m_current_column [private]
```

5.115.3.3 m_current_row

```
uint32_t mage::TextConsoleScript::m_current_row [private]
```

5.115.3.4 m_mutex

```
Mutex mage::TextConsoleScript::m_mutex [private]
```

5.115.3.5 m_nb_columns

```
const uint32_t mage::TextConsoleScript::m_nb_columns [private]
```

5.115.3.6 m_nb_rows

```
const uint32_t mage::TextConsoleScript::m_nb_rows [private]
```

5.115.3.7 m_temp_buffer

```
vector< wchar_t > mage::TextConsoleScript::m_temp_buffer [private]
```

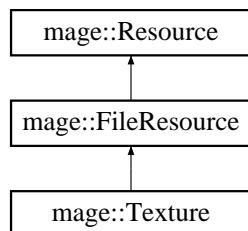
5.115.3.8 m_text

```
SharedPtr< SpriteText > mage::TextConsoleScript::m_text [private]
```

5.116 mage::Texture Class Reference

```
#include <texture.hpp>
```

Inheritance diagram for mage::Texture:



Public Member Functions

- [Texture \(ID3D11Device2 *device, const wstring &fname\)](#)
- [Texture \(const Texture &texture\)=delete](#)
- [Texture \(Texture &&texture\)=default](#)
- [virtual ~Texture \(\)=default](#)
- [Texture & operator= \(const Texture &texture\)=delete](#)
- [Texture & operator= \(Texture &&texture\)=delete](#)
- [ID3D11ShaderResourceView * Get \(\) const](#)
- [ID3D11ShaderResourceView *const * GetAddress \(\) const](#)
- [ID3D11ShaderResourceView ** GetAddress \(\)](#)

Private Attributes

- [ID3D11Device2 *const m_device](#)
- [ComPtr< ID3D11ShaderResourceView > m_texture_srv](#)

5.116.1 Detailed Description

A class of textures.

5.116.2 Constructor & Destructor Documentation

5.116.2.1 Texture() [1/3]

```
mage::Texture::Texture (
    ID3D11Device2 * device,
    const wstring & fname ) [explicit]
```

Constructs a texture.

Precondition

device is not equal to `nullptr`.

Parameters

| | | |
|----|---------------|------------------------------|
| in | <i>device</i> | A pointer to the device. |
| in | <i>fname</i> | A reference to the filename. |

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to initialize the texture. |
|---------------------------|-----------------------------------|

5.116.2.2 Texture() [2/3]

```
mage::Texture::Texture (
    const Texture & texture ) [delete]
```

Constructs a texture from the given texture.

Parameters

| | | |
|----|----------------|-------------------------------------|
| in | <i>texture</i> | A reference to the texture to copy. |
|----|----------------|-------------------------------------|

5.116.2.3 Texture() [3/3]

```
mage::Texture::Texture (
    Texture && texture ) [default]
```

Constructs a texture by moving the given texture.

Parameters

| | | |
|----|----------------|-------------------------------------|
| in | <i>texture</i> | A reference to the texture to move. |
|----|----------------|-------------------------------------|

5.116.2.4 ~Texture()

```
virtual mage::Texture::~Texture ( ) [virtual], [default]
```

Destructs this texture.

5.116.3 Member Function Documentation

5.116.3.1 Get()

```
ID3D11ShaderResourceView* mage::Texture::Get ( ) const
```

Returns a pointer to the shader resource view of this texture.

Returns

A pointer to the shader resource view of this texture.

5.116.3.2 GetAddress() [1/2]

```
ID3D11ShaderResourceView* const* mage::Texture::GetAddress ( ) const
```

Returns the address of the shader resource view of this texture.

Returns

A pointer to the pointer to the shader resource view of this texture.

5.116.3.3 GetAddress() [2/2]

```
ID3D11ShaderResourceView** mage::Texture::GetAddress ( )
```

Returns the address of the shader resource view of this texture.

Returns

A pointer to the pointer to the shader resource view of this texture.

5.116.3.4 operator=() [1/2]

```
Texture& mage::Texture::operator= (
    const Texture & texture ) [delete]
```

Copies the given texture to this texture.

Parameters

| | | |
|----|----------------|-------------------------------------|
| in | <i>texture</i> | A reference to the texture to copy. |
|----|----------------|-------------------------------------|

Returns

A reference to the copy of the given texture (i.e. this texture).

5.116.3.5 operator=() [2/2]

```
Texture& mage::Texture::operator= (
    Texture && texture ) [delete]
```

Moves the given texture to this texture.

Parameters

| | | |
|----|----------------|-------------------------------------|
| in | <i>texture</i> | A reference to the texture to move. |
|----|----------------|-------------------------------------|

Returns

A reference to the moved texture (i.e. this texture).

5.116.4 Member Data Documentation**5.116.4.1 m_device**

```
ID3D11Device2* const mage::Texture::m_device [private]
```

A pointer to the device of this texture.

5.116.4.2 m_texture_srv

```
ComPtr< ID3D11ShaderResourceView > mage::Texture::m_texture_srv [private]
```

A pointer to the shader resource view of this texture.

5.117 mage::Timer Class Reference

```
#include <timer.hpp>
```

Public Member Functions

- `Timer ()`
- `Timer (const Timer &timer)=default`
- `Timer (Timer &&timer)=default`
- `~Timer ()=default`
- `Timer & operator= (const Timer &timer)=default`
- `Timer & operator= (Timer &&timer)=default`
- `void Start ()`
- `void Stop ()`
- `void Restart ()`
- `void Resume ()`
- `double GetDeltaTime () const`
- `double GetTotalDeltaTime () const`

Private Member Functions

- `void UpdateLastTimestamp () const`
- `void ResetDeltaTime () const`
- `void UpdateDeltaTime () const`

Private Attributes

- `LARGE_INTEGER m_last_timestamp`
- `uint64_t m_delta_time`
- `uint64_t m_total_delta_time`
- `bool m_running`
- `LARGE_INTEGER m_time_frequency`
- `double m_time_period`

5.117.1 Detailed Description

A class of (high precision) wall clock timers.

5.117.2 Constructor & Destructor Documentation

5.117.2.1 `Timer()` [1/3]

```
mage::Timer::Timer ( )
```

Constructs a timer.

5.117.2.2 `Timer()` [2/3]

```
mage::Timer::Timer (
    const Timer & timer ) [default]
```

Constructs a timer from the given timer.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>timer</i> | A reference to the timer to copy. |
|----|--------------|-----------------------------------|

5.117.2.3 Timer() [3/3]

```
mage::Timer::Timer (
    Timer && timer ) [default]
```

Constructs a timer by moving the given timer.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>timer</i> | A reference to the timer to move. |
|----|--------------|-----------------------------------|

5.117.2.4 ~Timer()

```
mage::Timer::~Timer ( ) [default]
```

Destructs this timer.

5.117.3 Member Function Documentation**5.117.3.1 GetDeltaTime()**

```
double mage::Timer::GetDeltaTime ( ) const
```

Returns the wall clock delta time (in seconds) of this timer.

Returns

The wall clock delta time (in seconds) of this timer.

5.117.3.2 GetTotalDeltaTime()

```
double mage::Timer::GetTotalDeltaTime ( ) const
```

Returns the total wall clock delta time (in seconds) of this timer.

Returns

The total wall clock delta time (in seconds) of this timer.

5.117.3.3 operator=() [1/2]

```
Timer& mage::Timer::operator= (
    const Timer & timer ) [default]
```

Copies the given timer to this timer.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>timer</i> | A reference to the timer to copy. |
|----|--------------|-----------------------------------|

Returns

A reference to the copy of the given timer (i.e. this timer).

5.117.3.4 operator=() [2/2]

```
Timer& mage::Timer::operator= (
    Timer && timer ) [default]
```

Moves the given timer to this timer.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>timer</i> | A reference to the timer to move. |
|----|--------------|-----------------------------------|

Returns

A reference to the moved timer (i.e. this timer).

5.117.3.5 ResetDeltaTime()

```
void mage::Timer::ResetDeltaTime ( ) const [private]
```

Resets the delta time, total delta time and last timestamp of this timer.

5.117.3.6 Restart()

```
void mage::Timer::Restart ( )
```

Restarts this timer.

5.117.3.7 Resume()

```
void mage::Timer::Resume ( )
```

Resumes this timer.

5.117.3.8 Start()

```
void mage::Timer::Start ( )
```

Starts this timer.

5.117.3.9 Stop()

```
void mage::Timer::Stop ( )
```

Stops this timer.

5.117.3.10 UpdateDeltaTime()

```
void mage::Timer::UpdateDeltaTime ( ) const [private]
```

Updates the delta time, total delta time and last timestamp of this timer.

5.117.3.11 UpdateLastTimestamp()

```
void mage::Timer::UpdateLastTimestamp ( ) const [private]
```

Updates the last timestamp of this timer.

5.117.4 Member Data Documentation

5.117.4.1 m_delta_time

```
uint64_t mage::Timer::m_delta_time [mutable], [private]
```

The delta time of this timer.

5.117.4.2 m_last_timestamp

```
LARGE_INTEGER mage::Timer::m_last_timestamp [mutable], [private]
```

The last timestamp of this timer.

5.117.4.3 m_running

```
bool mage::Timer::m_running [private]
```

Flag indicating whether this timer is running.

5.117.4.4 m_time_frequency

```
LARGE_INTEGER mage::Timer::m_time_frequency [private]
```

The time frequency of this timer.

5.117.4.5 m_time_period

```
double mage::Timer::m_time_period [private]
```

The time period of this timer.

5.117.4.6 m_total_delta_time

```
uint64_t mage::Timer::m_total_delta_time [mutable], [private]
```

The total delta time of this timer.

5.118 mage::TransformNode Class Reference

```
#include <transform_node.hpp>
```

Public Member Functions

- `~TransformNode ()`
- `TransformNode & operator= (const TransformNode &transform_node)=delete`
- `TransformNode & operator= (TransformNode &&transform_node)=delete`
- `void SetTranslationX (float x)`
- `void SetTranslationY (float y)`
- `void SetTranslationZ (float z)`
- `void SetTranslation (float x, float y, float z)`
- `void SetTranslation (const XMFLOAT3 &translation)`
- `void SetTranslation (const XMVECTOR &translation)`
- `void AddTranslationX (float x)`
- `void AddTranslationY (float y)`
- `void AddTranslationZ (float z)`
- `void AddTranslation (float x, float y, float z)`
- `void AddTranslation (const XMFLOAT3 &translation)`
- `void AddTranslation (const XMVECTOR &translation)`
- `float GetTranslationX () const`
- `float GetTranslationY () const`
- `float GetTranslationZ () const`
- `const XMFLOAT3 GetTranslation () const`
- `const XMMATRIX GetObjectToParentTranslationMatrix () const`
- `const XMMATRIX GetParentToObjectTranslationMatrix () const`
- `void SetRotationX (float x)`
- `void SetRotationY (float y)`
- `void SetRotationZ (float z)`
- `void SetRotation (float x, float y, float z)`
- `void SetRotation (const XMFLOAT3 &rotation)`
- `void SetRotation (const XMVECTOR &rotation)`
- `void SetRotationAroundDirection (const XMVECTOR &normal, float angle)`
- `void AddRotationX (float x)`
- `void AddRotationY (float y)`
- `void AddRotationZ (float z)`
- `void AddRotation (float x, float y, float z)`

- void `AddRotation` (const XMFLOAT3 &rotation)
- void `AddRotation` (const XMVECTOR &rotation)
- float `GetRotationX` () const
- float `GetRotationY` () const
- float `GetRotationZ` () const
- const XMFLOAT3 `GetRotation` () const
- const XMMATRIX `GetObjectToParentRotationMatrix` () const
- const XMMATRIX `GetParentToObjectRotationMatrix` () const
- void `SetScaleX` (float x)
- void `SetScaleY` (float y)
- void `SetScaleZ` (float z)
- void `SetScale` (float s)
- void `SetScale` (float x, float y, float z)
- void `SetScale` (const XMFLOAT3 &scale)
- void `SetScale` (const XMVECTOR &scale)
- void `AddScaleX` (float x)
- void `AddScaleY` (float y)
- void `AddScaleZ` (float z)
- void `AddScale` (float s)
- void `AddScale` (float x, float y, float z)
- void `AddScale` (const XMFLOAT3 &scale)
- void `AddScale` (const XMVECTOR &scale)
- float `GetScaleX` () const
- float `GetScaleY` () const
- float `GetScaleZ` () const
- const XMFLOAT3 `GetScale` () const
- const XMMATRIX `GetObjectToParentScaleMatrix` () const
- const XMMATRIX `GetParentToObjectScaleMatrix` () const
- const XMVECTOR `GetObjectOrigin` () const
- const XMVECTOR `GetObjectAxisX` () const
- const XMVECTOR `GetObjectAxisY` () const
- const XMVECTOR `GetObjectAxisZ` () const
- const CartesianAxesSystem `GetObjectAxes` () const
- const CartesianCoordinateSystem `GetObjectCoordinateSystem` () const
- const XMVECTOR `GetParentOrigin` () const
- const XMVECTOR `GetParentAxisX` () const
- const XMVECTOR `GetParentAxisY` () const
- const XMVECTOR `GetParentAxisZ` () const
- const CartesianAxesSystem `GetParentAxes` () const
- const CartesianCoordinateSystem `GetParentCoordinateSystem` () const
- const XMVECTOR `GetWorldOrigin` () const
- const XMVECTOR `GetWorldAxisX` () const
- const XMVECTOR `GetWorldAxisY` () const
- const XMVECTOR `GetWorldAxisZ` () const
- const CartesianAxesSystem `GetWorldAxes` () const
- const CartesianCoordinateSystem `GetWorldCoordinateSystem` () const
- const XMVECTOR `GetObjectEye` () const
- const XMVECTOR `GetObjectLeft` () const
- const XMVECTOR `GetObjectUp` () const
- const XMVECTOR `GetObjectForward` () const
- const XMVECTOR `GetWorldEye` () const
- const XMVECTOR `GetWorldLeft` () const
- const XMVECTOR `GetWorldUp` () const
- const XMVECTOR `GetWorldForward` () const
- const XMMATRIX `GetObjectToParentMatrix` () const

- const XMMATRIX GetParentToObjectMatrix () const
- const XMMATRIX GetObjectToWorldMatrix () const
- const XMMATRIX GetWorldToObjectMatrix () const
- const XMMATRIX GetViewToWorldMatrix () const
- const XMMATRIX GetWorldToViewMatrix () const
- const XMVECTOR TransformObjectToParent (const XMVECTOR &vector) const
- const XMVECTOR TransformParentToObject (const XMVECTOR &vector) const
- const XMVECTOR TransformObjectToWorld (const XMVECTOR &vector) const
- const XMVECTOR TransformWorldToObject (const XMVECTOR &vector) const

Private Member Functions

- TransformNode ()
- TransformNode (const TransformNode &transform_node)
- TransformNode (TransformNode &&transform_node)
- void SetDirty () const
- void UpdateObjectToWorldMatrix () const
- void UpdateWorldToObjectMatrix () const
- bool HasParentNode () const
- Node * GetparentNode () const
- size_t GetNumberOfChildNodes () const
- bool HasChildNode (SharedPtr< const Node > node) const
- void RemoveAllChildNodes ()
- template<typename ActionT>
void ForEachChildTransformNode (ActionT action) const
- template<typename ActionT>
void ForEachDescendantTransformNode (ActionT action) const
- template<typename ActionT>
void ForEachChildNode (ActionT action) const
- template<typename ActionT>
void ForEachDescendantNode (ActionT action) const

Private Attributes

- UniquePtr< Transform > m_transform
- Node * m_parent
- vector< SharedPtr< Node > > m_childs
- XMMATRIX m_object_to_world
- XMMATRIX m_world_to_object
- bool m_dirty_object_to_world
- bool m_dirty_world_to_object

Friends

- class Node

5.118.1 Detailed Description

A struct of transform nodes.

5.118.2 Constructor & Destructor Documentation

5.118.2.1 ~TransformNode()

```
mage::TransformNode::~TransformNode ()
```

Destructs this transform node.

5.118.2.2 TransformNode() [1/3]

```
mage::TransformNode::TransformNode () [explicit], [private]
```

Constructs a transform node.

5.118.2.3 TransformNode() [2/3]

```
mage::TransformNode::TransformNode (
    const TransformNode & transform_node ) [private]
```

Constructs a transform node from the given transform node.

Parameters

| | | |
|----|----------------|--|
| in | transform_node | A reference to the transform node to copy. |
|----|----------------|--|

5.118.2.4 TransformNode() [3/3]

```
mage::TransformNode::TransformNode (
    TransformNode && transform_node ) [private]
```

Constructs a transform node by moving the given transform node.

Parameters

| | | |
|----|----------------|--|
| in | transform_node | A reference to the transform node to move. |
|----|----------------|--|

5.118.3 Member Function Documentation

5.118.3.1 AddRotation() [1/3]

```
void mage::TransformNode::AddRotation (
    float x,
    float y,
    float z )
```

Adds the given rotation component to the rotation component of this transform node.

Parameters

| | | |
|----|----------|---|
| in | <i>x</i> | The x-value of the rotation component to add. |
| in | <i>y</i> | The y-value of the rotation component to add. |
| in | <i>z</i> | The z-value of the rotation component to add. |

5.118.3.2 AddRotation() [2/3]

```
void mage::TransformNode::AddRotation (
    const XMFLOAT3 & rotation )
```

Adds the given rotation component to the rotation component of this transform node.

Parameters

| | | |
|----|-----------------|---|
| in | <i>rotation</i> | A reference to the rotation component to add. |
|----|-----------------|---|

5.118.3.3 AddRotation() [3/3]

```
void mage::TransformNode::AddRotation (
    const XMVECTOR & rotation )
```

Adds the given rotation component to the rotation component of this transform node.

Parameters

| | | |
|----|-----------------|---|
| in | <i>rotation</i> | A reference to the rotation component to add. |
|----|-----------------|---|

5.118.3.4 AddRotationX()

```
void mage::TransformNode::AddRotationX (
    float x )
```

Adds the given x-value to the rotation component of this transform node.

Parameters

| | | |
|----|----------|---|
| in | <i>x</i> | The x-value of the rotation component to add. |
|----|----------|---|

5.118.3.5 AddRotationY()

```
void mage::TransformNode::AddRotationY (
    float y )
```

Adds the given y-value to the rotation component of this transform node.

Parameters

| | | |
|----|---|---|
| in | y | The y-value of the rotation component to add. |
|----|---|---|

5.118.3.6 AddRotationZ()

```
void mage::TransformNode::AddRotationZ (
    float z )
```

Adds the given z-value to the rotation component of this transform node.

Parameters

| | | |
|----|---|---|
| in | z | The z-value of the rotation component to add. |
|----|---|---|

5.118.3.7 AddScale() [1/4]

```
void mage::TransformNode::AddScale (
    float s )
```

Adds the given scale component to the scale component of this transform node.

Parameters

| | | |
|----|---|-----------------------------|
| in | s | The scale component to add. |
|----|---|-----------------------------|

5.118.3.8 AddScale() [2/4]

```
void mage::TransformNode::AddScale (
    float x,
    float y,
    float z )
```

Adds the given scale component to the scale component of this transform node.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the scale component to add. |
| in | y | The y-value of the scale component to add. |
| in | z | The z-value of the scale component to add. |

5.118.3.9 AddScale() [3/4]

```
void mage::TransformNode::AddScale (
    const XMFLOAT3 & scale )
```

Adds the given scale component to the scale component of this transform node.

Parameters

| | | |
|----|-------|--|
| in | scale | A reference to the scale component to add. |
|----|-------|--|

5.118.3.10 AddScale() [4/4]

```
void mage::TransformNode::AddScale (
    const XMVECTOR & scale )
```

Adds the given scale component to the scale component of this transform node.

Parameters

| | | |
|----|-------|--|
| in | scale | A reference to the scale component to add. |
|----|-------|--|

5.118.3.11 AddScaleX()

```
void mage::TransformNode::AddScaleX (
    float x )
```

Adds the given x-value to the scale component of this transform node.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the scale component to add. |
|----|---|--|

5.118.3.12 AddScaleY()

```
void mage::TransformNode::AddScaleY (
    float y )
```

Adds the given y-value to the scale component of this transform node.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the scale component to add. |
|----|---|--|

5.118.3.13 AddScaleZ()

```
void mage::TransformNode::AddScaleZ (
    float z )
```

Adds the given z-value to the scale component of this transform node.

Parameters

| | | |
|----|----------|--|
| in | <i>z</i> | The z-value of the scale component to add. |
|----|----------|--|

5.118.3.14 AddTranslation() [1/3]

```
void mage::TransformNode::AddTranslation (
    float x,
    float y,
    float z )
```

Adds the given translation component to the translation component of this transform node.

Parameters

| | | |
|----|----------|--|
| in | <i>x</i> | The x-value of the translation component to add. |
| in | <i>y</i> | The y-value of the translation component to add. |
| in | <i>z</i> | The z-value of the translation component to add. |

5.118.3.15 AddTranslation() [2/3]

```
void mage::TransformNode::AddTranslation (
    const XMFLOAT3 & translation )
```

Adds the given translation component to the translation component of this transform node.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the translation component to add. |
|----|--------------------|--|

5.118.3.16 AddTranslation() [3/3]

```
void mage::TransformNode::AddTranslation (
    const XMVECTOR & translation )
```

Adds the given translation component to the translation component of this transform node.

Parameters

| | | |
|----|--------------------|--|
| in | <i>translation</i> | A reference to the translation component to add. |
|----|--------------------|--|

5.118.3.17 AddTranslationX()

```
void mage::TransformNode::AddTranslationX (
    float x )
```

Adds the given x-value to the translation component of this transform node.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the translation component to add. |
|----|---|--|

5.118.3.18 AddTranslationY()

```
void mage::TransformNode::AddTranslationY (
    float y )
```

Adds the given y-value to the translation component of this transform node.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the translation component to add. |
|----|---|--|

5.118.3.19 AddTranslationZ()

```
void mage::TransformNode::AddTranslationZ (
    float z )
```

Adds the given z-value to the translation component of this transform node.

Parameters

| | | |
|----|---|--|
| in | z | The z-value of the translation component to add. |
|----|---|--|

5.118.3.20 ForEachChildNode()

```
template<typename ActionT >
void mage::TransformNode::ForEachChildNode (
    ActionT action ) const [private]
```

Traverses all child nodes of this transform node.

Template Parameters

| | |
|---------|---|
| ActionT | An action to perform on all child nodes of this transform node. The action must accept (const) Node & values. |
|---------|---|

5.118.3.21 ForEachChildTransformNode()

```
template<typename ActionT >
void mage::TransformNode::ForEachChildTransformNode (
    ActionT action ) const [private]
```

Traverses all child transform nodes of this transform node.

Template Parameters

| | |
|----------------|--|
| <i>ActionT</i> | An action to perform on all child transform nodes of this transform node. The action must accept (const) TransformNode & values. |
|----------------|--|

5.118.3.22 [ForEachDescendantNode\(\)](#)

```
template<typename ActionT >
void mage::TransformNode::ForEachDescendantNode (
    ActionT action ) const [private]
```

Traverses all descendant (childs included) nodes of this transform node.

Template Parameters

| | |
|----------------|--|
| <i>ActionT</i> | An action to perform on all descendant nodes of this transform node. The action must accept (const) Node & values. |
|----------------|--|

5.118.3.23 [ForEachDescendantTransformNode\(\)](#)

```
template<typename ActionT >
void mage::TransformNode::ForEachDescendantTransformNode (
    ActionT action ) const [private]
```

Traverses all descendant (childs included) transform nodes of this transform node.

Template Parameters

| | |
|----------------|---|
| <i>ActionT</i> | An action to perform on all descendant transform nodes of this transform node. The action must accept (const) TransformNode & values. |
|----------------|---|

5.118.3.24 [GetNumberOfChildNodes\(\)](#)

```
size_t mage::TransformNode::GetNumberOfChildNodes ( ) const [private]
```

Returns the number of child nodes of this transform node.

Returns

The number of child nodes of this transform node.

5.118.3.25 GetObjectAxes()

```
const CartesianAxesSystem mage::TransformNode::GetObjectAxes () const
```

Returns the local Cartesian axes system of this transform node in object space coordinates.

Returns

The local Cartesian axes system of this transform node expressed in object space coordinates.

5.118.3.26 GetObjectAxisX()

```
const XMVECTOR mage::TransformNode::GetObjectAxisX () const
```

Returns the direction of the local x-axis of this transform node expressed in object space coordinates.

Returns

The direction of the local x-axis of this transform node expressed in object space coordinates.

5.118.3.27 GetObjectAxisY()

```
const XMVECTOR mage::TransformNode::GetObjectAxisY () const
```

Returns the direction of the local y-axis of this transform node expressed in object space coordinates.

Returns

The direction of the local y-axis of this transform node expressed in object space coordinates.

5.118.3.28 GetObjectAxisZ()

```
const XMVECTOR mage::TransformNode::GetObjectAxisZ () const
```

Returns the direction of the local z-axis of this transform node expressed in object space coordinates.

Returns

The direction of the local z-axis of this transform node expressed in object space coordinates.

5.118.3.29 GetObjectCoordinateSystem()

```
const CartesianCoordinateSystem mage::TransformNode::GetObjectCoordinateSystem () const
```

Returns the local Cartesian coordinate system of this transform node in object space coordinates.

Returns

The local Cartesian coordinate system of this transform node expressed in object space coordinates.

5.118.3.30 GetObjectEye()

```
const XMVECTOR mage::TransformNode::GetObjectEye() const
```

Returns the local eye position of this transform node expressed in object space coordinates.

Returns

The local eye position of this transform node expressed in object space coordinates.

5.118.3.31 GetObjectForward()

```
const XMVECTOR mage::TransformNode::GetObjectForward() const
```

Returns the local forward direction of this transform node expressed in object space coordinates.

Returns

The local forward direction of this transform node expressed in object space coordinates.

5.118.3.32 GetObjectLeft()

```
const XMVECTOR mage::TransformNode::GetObjectLeft() const
```

Returns the local left direction of this transform node expressed in object space coordinates.

Returns

The local left direction of this transform node expressed in object space coordinates.

5.118.3.33 GetObjectOrigin()

```
const XMVECTOR mage::TransformNode::GetObjectOrigin() const
```

Returns the position of the local origin of this transform node expressed in object space coordinates.

Returns

The position of the local origin of this transform node expressed in object space coordinates.

5.118.3.34 GetObjectToParentMatrix()

```
const XMMATRIX mage::TransformNode::GetObjectToParentMatrix() const
```

Returns the object-to-parent matrix of this transform node.

Returns

The object-to-parent matrix of this transform node.

5.118.3.35 GetObjectToParentRotationMatrix()

```
const XMMATRIX mage::TransformNode::GetObjectToParentRotationMatrix() const
```

Returns the object-to-parent rotation matrix of this transform node.

Returns

The object-to-parent rotation matrix of this transform node.

5.118.3.36 GetObjectToParentScaleMatrix()

```
const XMMATRIX mage::TransformNode::GetObjectToParentScaleMatrix() const
```

Returns the object-to-parent scale matrix of this transform node.

Returns

The scale object-to-parent matrix of this transform node.

5.118.3.37 GetObjectToParentTranslationMatrix()

```
const XMMATRIX mage::TransformNode::GetObjectToParentTranslationMatrix() const
```

Returns the object-to-parent translation matrix of this transform node.

Returns

The object-to-parent translation matrix of this transform node.

5.118.3.38 GetObjectToWorldMatrix()

```
const XMMATRIX mage::TransformNode::GetObjectToWorldMatrix() const
```

Returns the object-to-world matrix of this transform node.

Returns

The object-to-world matrix of this transform node.

5.118.3.39 GetObjectUp()

```
const XMVECTOR mage::TransformNode::GetObjectUp() const
```

Returns the local up direction of this transform node expressed in object space coordinates.

Returns

The local up direction of this transform node expressed in object space coordinates.

5.118.3.40 GetParentAxes()

```
const CartesianAxesSystem mage::TransformNode::GetParentAxes () const
```

Returns the local Cartesian axes system of this transform node expressed in parent space coordinates.

Returns

The local Cartesian axes system of this transform node expressed in parent space coordinates.

5.118.3.41 GetParentAxisX()

```
const XMVECTOR mage::TransformNode::GetParentAxisX () const
```

Returns the direction of the local x-axis of this transform node expressed in parent space coordinates.

Returns

The direction of the local x-axis of this transform node expressed in parent space coordinates.

5.118.3.42 GetParentAxisY()

```
const XMVECTOR mage::TransformNode::GetParentAxisY () const
```

Returns the direction of the local y-axis of this transform node expressed in parent space coordinates.

Returns

The direction of the local y-axis of this transform node expressed in parent space coordinates.

5.118.3.43 GetParentAxisZ()

```
const XMVECTOR mage::TransformNode::GetParentAxisZ () const
```

Returns the direction of the local z-axis of this transform node expressed in parent space coordinates.

Returns

The direction of the local z-axis of this transform node expressed in parent space coordinates.

5.118.3.44 GetParentCoordinateSystem()

```
const CartesianCoordinateSystem mage::TransformNode::GetParentCoordinateSystem () const
```

Returns the local Cartesian coordinate system of this transform node in parent space coordinates.

Returns

The local Cartesian coordinate system of this transform node expressed in parent space coordinates.

5.118.3.45 GetParentNode()

```
Node* mage::TransformNode::GetParentNode ( ) const [private]
```

Returns the parent node of this transform node.

Returns

`nullptr` if this transform node has no parent node.
A pointer to the parent node of this transform node.

5.118.3.46 GetParentOrigin()

```
const XMVECTOR mage::TransformNode::GetParentOrigin ( ) const
```

Returns the position of the local origin of this transform node expressed in parent space coordinates.

Returns

The position of the local origin of this transform node expressed in parent space coordinates.

5.118.3.47 GetParentToObjectMatrix()

```
const XMMATRIX mage::TransformNode::GetParentToObjectMatrix ( ) const
```

Returns the parent-to-object matrix of this transform node.

Returns

The parent-to-object matrix of this transform node.

5.118.3.48 GetParentToObjectRotationMatrix()

```
const XMMATRIX mage::TransformNode::GetParentToObjectRotationMatrix ( ) const
```

Returns the parent-to-object rotation matrix of this transform node.

Returns

The parent-to-object rotation matrix of this transform node.

5.118.3.49 GetParentToObjectScaleMatrix()

```
const XMMATRIX mage::TransformNode::GetParentToObjectScaleMatrix ( ) const
```

Returns the parent-to-object scale matrix of this transform node.

Returns

The parent-to-object scale matrix of this transform node.

5.118.3.50 GetParentToObjectTranslationMatrix()

```
const XMMATRIX mage::TransformNode::GetParentToObjectTranslationMatrix ( ) const
```

Returns the parent-to-object translation matrix of this transform node.

Returns

The parent-to-object translation matrix of this transform node.

5.118.3.51 GetRotation()

```
const XMFLOAT3 mage::TransformNode::GetRotation ( ) const
```

Returns the rotation component of this transform node.

Returns

The rotation component of this transform node.

5.118.3.52 GetRotationX()

```
float mage::TransformNode::GetRotationX ( ) const
```

Returns the x-value of the rotation component of this transform node.

Returns

The x-value of the rotation component of this transform node.

5.118.3.53 GetRotationY()

```
float mage::TransformNode::GetRotationY ( ) const
```

Returns the y-value of the rotation component of this transform node.

Returns

The y-value of the rotation component of this transform node.

5.118.3.54 GetRotationZ()

```
float mage::TransformNode::GetRotationZ ( ) const
```

Returns the z-value of the rotation component of this transform node.

Returns

The z-value of the rotation component of this transform node.

5.118.3.55 GetScale()

```
const XMFLOAT3 mage::TransformNode::GetScale () const
```

Returns the scale component of this transform node.

Returns

The scale component of this transform node.

5.118.3.56 GetScaleX()

```
float mage::TransformNode::GetScaleX () const
```

Returns the x-value of the scale component of this transform node.

Returns

The x-value of the scale component of this transform node.

5.118.3.57 GetScaleY()

```
float mage::TransformNode::GetScaleY () const
```

Returns the y-value of the scale component of this transform node.

Returns

The y-value of the scale component of this transform node.

5.118.3.58 GetScaleZ()

```
float mage::TransformNode::GetScaleZ () const
```

Returns the z-value of the scale component of this transform node.

Returns

The z-value of the scale component of this transform node.

5.118.3.59 GetTranslation()

```
const XMFLOAT3 mage::TransformNode::GetTranslation () const
```

Returns the translation component of this transform node.

Returns

The translation component of this transform node.

5.118.3.60 GetTranslationX()

```
float mage::TransformNode::GetTranslationX ( ) const
```

Returns the x-value of the translation component of this transform node.

Returns

The x-value of the translation component of this transform node.

5.118.3.61 GetTranslationY()

```
float mage::TransformNode::GetTranslationY ( ) const
```

Returns the y-value of the translation component of this transform node.

Returns

The y-value of the translation component of this transform node.

5.118.3.62 GetTranslationZ()

```
float mage::TransformNode::GetTranslationZ ( ) const
```

Returns the z-value of the translation component of this transform node.

Returns

The z-value of the translation component of this transform node.

5.118.3.63 GetViewToWorldMatrix()

```
const XMMATRIX mage::TransformNode::GetViewToWorldMatrix ( ) const
```

Returns the view-to-world matrix of this transform node.

Returns

The view-to-world matrix of this transform node.

Note

Transforms for cameras should not contain scaling components.

5.118.3.64 GetWorldAxes()

```
const CartesianAxesSystem mage::TransformNode::GetWorldAxes() const
```

Returns the local Cartesian axes system of this transform node expressed in world space coordinates.

Returns

The local Cartesian axes system of this transform node expressed in world space coordinates.

5.118.3.65 GetWorldAxisX()

```
const XMVECTOR mage::TransformNode::GetWorldAxisX() const
```

Returns the direction of the local x-axis of this transform node expressed in world space coordinates.

Returns

The direction of the local x-axis of this transform node expressed in world space coordinates.

5.118.3.66 GetWorldAxisY()

```
const XMVECTOR mage::TransformNode::GetWorldAxisY() const
```

Returns the direction of the local y-axis of this transform node expressed in world space coordinates.

Returns

The direction of the local y-axis of this transform node expressed in world space coordinates.

5.118.3.67 GetWorldAxisZ()

```
const XMVECTOR mage::TransformNode::GetWorldAxisZ() const
```

Returns the direction of the local z-axis of this transform node expressed in world space coordinates.

Returns

The direction of the local z-axis of this transform node expressed in world space coordinates.

5.118.3.68 GetWorldCoordinateSystem()

```
const CartesianCoordinateSystem mage::TransformNode::GetWorldCoordinateSystem() const
```

Returns the local Cartesian coordinate system of this transform node in world space coordinates.

Returns

The local Cartesian coordinate system of this transform node expressed in world space coordinates.

5.118.3.69 GetWorldEye()

```
const XMVECTOR mage::TransformNode::GetWorldEye() const
```

Returns the local eye position of this transform node expressed in world space coordinates.

Returns

The local eye position of this transform node expressed in world space coordinates.

5.118.3.70 GetWorldForward()

```
const XMVECTOR mage::TransformNode::GetWorldForward() const
```

Returns the local forward direction of this transform node expressed in world space coordinates.

Returns

The local forward direction of this transform node expressed in world space coordinates.

5.118.3.71 GetWorldLeft()

```
const XMVECTOR mage::TransformNode::GetWorldLeft() const
```

Returns the local left direction of this transform node expressed in world space coordinates.

Returns

The local left direction of this transform node expressed in world space coordinates.

5.118.3.72 GetWorldOrigin()

```
const XMVECTOR mage::TransformNode::GetWorldOrigin() const
```

Returns the position of the local origin of this transform node expressed in world space coordinates.

Returns

The position of the local origin of this transform node expressed in world space coordinates.

5.118.3.73 GetWorldToObjectMatrix()

```
const XMMATRIX mage::TransformNode::GetWorldToObjectMatrix() const
```

Returns the world-to-object matrix of this transform node.

Returns

The world-to-object matrix of this transform node.

5.118.3.74 GetWorldToViewMatrix()

```
const XMATRIX mage::TransformNode::GetWorldToViewMatrix ( ) const
```

Returns the world-to-view matrix of this transform node.

Returns

The world-to-view matrix of this transform node.

Note

Transforms for cameras should not contain scaling components.

5.118.3.75 GetWorldUp()

```
const XMVECTOR mage::TransformNode::GetWorldUp ( ) const
```

Returns the local up direction of this transform node expressed in world space coordinates.

Returns

The local up direction of this transform node expressed in world space coordinates.

5.118.3.76 HasChildNode()

```
bool mage::TransformNode::HasChildNode (
    SharedPtr< const Node > node ) const [private]
```

Checks whether this transform node contains the given node as a child node.

Parameters

| | | |
|----|-------------|------------------------|
| in | <i>node</i> | A pointer to the node. |
|----|-------------|------------------------|

Returns

`true` if this transform node contains the given node as a child node. `false` otherwise.

5.118.3.77 HasParentNode()

```
bool mage::TransformNode::HasParentNode ( ) const [private]
```

Checks whether this transform node has a parent node.

Returns

`true` if this transform node has a parent node. `false` otherwise.

5.118.3.78 operator=() [1/2]

```
TransformNode& mage::TransformNode::operator= (
    const TransformNode & transform_node ) [delete]
```

Copies the given transform node to this transform node.

Parameters

| | | |
|----|-----------------------|--|
| in | <i>transform_node</i> | A reference to the transform node to copy. |
|----|-----------------------|--|

Returns

A reference to the copy of the given transform node (i.e. this transform node).

5.118.3.79 operator=() [2/2]

```
TransformNode& mage::TransformNode::operator= (
    TransformNode && transform_node ) [delete]
```

Moves the given transform node to this transform node.

Parameters

| | | |
|----|-----------------------|--|
| in | <i>transform_node</i> | A reference to the transform node to move. |
|----|-----------------------|--|

Returns

A reference to the copy of the given transform node (i.e. this transform node).

5.118.3.80 RemoveAllChildNodes()

```
void mage::TransformNode::RemoveAllChildNodes ( ) [private]
```

Removes all child nodes from this transform node.

5.118.3.81 SetDirty()

```
void mage::TransformNode::SetDirty ( ) const [private]
```

Sets this transform node to dirty.

5.118.3.82 SetRotation() [1/3]

```
void mage::TransformNode::SetRotation (
    float x,
    float y,
    float z )
```

Sets the rotation component of this transform node to the given rotation component.

Parameters

| | | |
|----|----------|--|
| in | <i>x</i> | The x-value of the rotation component. |
| in | <i>y</i> | The y-value of the rotation component. |
| in | <i>z</i> | The z-value of the rotation component. |

5.118.3.83 SetRotation() [2/3]

```
void mage::TransformNode::SetRotation (
    const XMFLOAT3 & rotation )
```

Sets the rotation component of this transform node to the given rotation component.

Parameters

| | | |
|----|-----------------|--|
| in | <i>rotation</i> | A reference to the rotation component. |
|----|-----------------|--|

5.118.3.84 SetRotation() [3/3]

```
void mage::TransformNode::SetRotation (
    const XMVECTOR & rotation )
```

Sets the rotation component of this transform node to the given rotation component.

Parameters

| | | |
|----|-----------------|--|
| in | <i>rotation</i> | A reference to the rotation component. |
|----|-----------------|--|

5.118.3.85 SetRotationAroundDirection()

```
void mage::TransformNode::SetRotationAroundDirection (
    const XMVECTOR & normal,
    float angle )
```

Sets the rotation component to a rotation of the given angle around the given normal.

Parameters

| | | |
|----|---------------|----------------------------|
| in | <i>normal</i> | A reference to the normal. |
| in | <i>angle</i> | The angle. |

5.118.3.86 SetRotationX()

```
void mage::TransformNode::SetRotationX (
    float x )
```

Sets the x-value of the rotation component of this transform node to the given value.

Parameters

| | | |
|----|---|--|
| in | x | The x-value of the rotation component. |
|----|---|--|

5.118.3.87 SetRotationY()

```
void mage::TransformNode::SetRotationY (
    float y )
```

Sets the y-value of the rotation component of this transform node to the given value.

Parameters

| | | |
|----|---|--|
| in | y | The y-value of the rotation component. |
|----|---|--|

5.118.3.88 SetRotationZ()

```
void mage::TransformNode::SetRotationZ (
    float z )
```

Sets the z-value of the rotation component of this transform node to the given value.

Parameters

| | | |
|----|---|--|
| in | z | The z-value of the rotation component. |
|----|---|--|

5.118.3.89 SetScale() [1/4]

```
void mage::TransformNode::SetScale (
    float s )
```

Sets the scale component of this transform node to the given scale component.

Parameters

| | | |
|----|---|----------------------|
| in | s | The scale component. |
|----|---|----------------------|

5.118.3.90 SetScale() [2/4]

```
void mage::TransformNode::SetScale (
    float x,
    float y,
    float z )
```

Sets the scale component of this transform node to the given scale component.

Parameters

| | | |
|----|----------|-------------------------------------|
| in | <i>x</i> | The x-value of the scale component. |
| in | <i>y</i> | The y-value of the scale component. |
| in | <i>z</i> | The z-value of the scale component. |

5.118.3.91 SetScale() [3/4]

```
void mage::TransformNode::SetScale (
    const XMFLOAT3 & scale )
```

Sets the scale component of this transform node to the given scale component.

Parameters

| | | |
|----|--------------|-------------------------------------|
| in | <i>scale</i> | A reference to the scale component. |
|----|--------------|-------------------------------------|

5.118.3.92 SetScale() [4/4]

```
void mage::TransformNode::SetScale (
    const XMVECTOR & scale )
```

Sets the scale component of this transform node to the given scale component.

Parameters

| | | |
|----|--------------|-------------------------------------|
| in | <i>scale</i> | A reference to the scale component. |
|----|--------------|-------------------------------------|

5.118.3.93 SetScaleX()

```
void mage::TransformNode::SetScaleX (
    float x )
```

Sets the x-value of the scale component of this transform node to the given value.

Parameters

| | | |
|----|----------|-------------------------------------|
| in | <i>x</i> | The x-value of the scale component. |
|----|----------|-------------------------------------|

5.118.3.94 SetScaleY()

```
void mage::TransformNode::SetScaleY (
    float y )
```

Sets the y-value of the scale component of this transform node to the given value.

Parameters

| | | |
|----|----------|-------------------------------------|
| in | <i>y</i> | The y-value of the scale component. |
|----|----------|-------------------------------------|

5.118.3.95 SetScaleZ()

```
void mage::TransformNode::SetScaleZ (
    float z )
```

Sets the z-value of the scale component of this transform node to the given value.

Parameters

| | | |
|----|----------|-------------------------------------|
| in | <i>z</i> | The z-value of the scale component. |
|----|----------|-------------------------------------|

5.118.3.96 SetTranslation() [1/3]

```
void mage::TransformNode::SetTranslation (
    float x,
    float y,
    float z )
```

Sets the translation component of this transform node to the given translation component.

Parameters

| | | |
|----|----------|---|
| in | <i>x</i> | The x-value of the translation component. |
| in | <i>y</i> | The y-value of the translation component. |
| in | <i>z</i> | The z-value of the translation component. |

5.118.3.97 SetTranslation() [2/3]

```
void mage::TransformNode::SetTranslation (
    const XMFLOAT3 & translation )
```

Sets the translation component of this transform node to the given translation component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
|----|--------------------|---|

5.118.3.98 SetTranslation() [3/3]

```
void mage::TransformNode::SetTranslation (
    const XMVECTOR & translation )
```

Sets the translation component of this transform node to the given translation component.

Parameters

| | | |
|----|--------------------|---|
| in | <i>translation</i> | A reference to the translation component. |
|----|--------------------|---|

5.118.3.99 SetTranslationX()

```
void mage::TransformNode::SetTranslationX (
    float x )
```

Sets the x-value of the translation component of this transform node to the given value.

Parameters

| | | |
|----|----------|---|
| in | <i>x</i> | The x-value of the translation component. |
|----|----------|---|

5.118.3.100 SetTranslationY()

```
void mage::TransformNode::SetTranslationY (
    float y )
```

Sets the y-value of the translation component of this transform node to the given value.

Parameters

| | | |
|----|----------|---|
| in | <i>y</i> | The y-value of the translation component. |
|----|----------|---|

5.118.3.101 SetTranslationZ()

```
void mage::TransformNode::SetTranslationZ (
    float z )
```

Sets the z-value of the translation component of this transform node to the given value.

Parameters

| | | |
|----|----------|---|
| in | <i>z</i> | The z-value of the translation component. |
|----|----------|---|

5.118.3.102 TransformObjectToParent()

```
const XMVECTOR mage::TransformNode::TransformObjectToParent (
    const XMVECTOR & vector ) const
```

Transforms the given vector expressed in object space coordinates to parent space coordinates.

Parameters

| | | |
|----|--------|--|
| in | vector | A reference to the vector expressed in object space coordinates. |
|----|--------|--|

Returns

The transformed vector expressed in parent space coordinates.

5.118.3.103 TransformObjectToWorld()

```
const XMVECTOR mage::TransformNode::TransformObjectToWorld (
    const XMVECTOR & vector ) const
```

Transforms the given vector expressed in object space coordinates to world space coordinates.

Parameters

| | | |
|----|--------|--|
| in | vector | A reference to the vector expressed in object space coordinates. |
|----|--------|--|

Returns

The transformed vector expressed in world space coordinates.

5.118.3.104 TransformParentToObject()

```
const XMVECTOR mage::TransformNode::TransformParentToObject (
    const XMVECTOR & vector ) const
```

Transforms the given vector expressed in parent space coordinates to object space coordinates.

Parameters

| | | |
|----|--------|--|
| in | vector | A reference to the vector expressed in parent space coordinates. |
|----|--------|--|

Returns

The transformed vector expressed in object space coordinates.

5.118.3.105 TransformWorldToObject()

```
const XMVECTOR mage::TransformNode::TransformWorldToObject (
    const XMVECTOR & vector ) const
```

Transforms the given vector expressed in world space coordinates to object space coordinates.

Parameters

| | | |
|-----------------|---------------------|---|
| <code>in</code> | <code>vector</code> | A reference to the vector expressed in world space coordinates. |
|-----------------|---------------------|---|

Returns

The transformed vector expressed in object space coordinates.

5.118.3.106 UpdateObjectToWorldMatrix()

```
void mage::TransformNode::UpdateObjectToWorldMatrix ( ) const [private]
```

Updates the object-to-world matrix of this transform node if dirty.

5.118.3.107 UpdateWorldToObjectMatrix()

```
void mage::TransformNode::UpdateWorldToObjectMatrix ( ) const [private]
```

Updates the world-to-object matrix of this transform node if dirty.

5.118.4 Friends And Related Function Documentation**5.118.4.1 Node**

```
friend class Node [friend]
```

5.118.5 Member Data Documentation**5.118.5.1 m_childs**

```
vector< SharedPtr< Node > > mage::TransformNode::m_childs [private]
```

The child transform nodes of this transform node.

5.118.5.2 m_dirty_object_to_world

```
bool mage::TransformNode::m_dirty_object_to_world [mutable], [private]
```

A flag indicating whether the object-to-world matrix of this transform node are dirty.

5.118.5.3 m_dirty_world_to_object

```
bool mage::TransformNode::m_dirty_world_to_object [mutable], [private]
```

A flag indicating whether the world-to-object matrix of this transform node are dirty.

5.118.5.4 m_object_to_world

```
XMMATRIX mage::TransformNode::m_object_to_world [mutable], [private]
```

The cached object-to-world matrix of this transform node.

5.118.5.5 m_parent

```
Node* mage::TransformNode::m_parent [private]
```

The parent transform node of this transform node.

5.118.5.6 m_transform

```
UniquePtr< Transform > mage::TransformNode::m_transform [private]
```

The transform of this transform node.

5.118.5.7 m_world_to_object

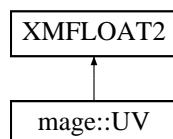
```
XMMATRIX mage::TransformNode::m_world_to_object [mutable], [private]
```

The cached world-to-object matrix of this transform node.

5.119 mage::UV Struct Reference

```
#include <math.hpp>
```

Inheritance diagram for mage::UV:



Public Member Functions

- [UV \(\)](#)
- [UV \(float u, float v\)](#)
- [UV \(const UV &uv\)](#)
- [UV \(UV &&uv\)](#)
- [UV \(const XMFLOAT2 &v\)](#)
- [UV \(XMFLOAT2 &&v\)](#)
- [~UV \(\)=default](#)
- [UV & operator= \(const UV &uv\)](#)
- [UV & operator= \(UV &&uv\)](#)

5.119.1 Detailed Description

A struct of [UV](#) texture coordinates.

5.119.2 Constructor & Destructor Documentation

5.119.2.1 UV() [1/6]

```
mage::UV::UV ( )
```

Constructs a set of [UV](#) texture coordinates.

5.119.2.2 UV() [2/6]

```
mage::UV::UV (
    float u,
    float v )
```

Constructs a set of [UV](#) texture coordinates.

Parameters

| | | |
|----|----------|---------------------------|
| in | <i>u</i> | The u texture coordinate. |
| in | <i>v</i> | The v texture coordinate. |

5.119.2.3 UV() [3/6]

```
mage::UV::UV (
    const UV & uv )
```

Constructs a set of [UV](#) texture coordinates from the given set of [UV](#) texture coordinates.

Parameters

| | | |
|----|-----------|---|
| in | <i>uv</i> | A reference to the set of UV texture coordinates to copy. |
|----|-----------|---|

5.119.2.4 UV() [4/6]

```
mage::UV::UV (
    UV && uv )
```

Constructs a set of [UV](#) texture coordinates by moving the given set of [UV](#) texture coordinates.

Parameters

| | | |
|----|-----------|---|
| in | <i>uv</i> | A reference to the set of UV texture coordinates to move. |
|----|-----------|---|

5.119.2.5 UV() [5/6]

```
mage::UV::UV (
    const XMFLOAT2 & v ) [explicit]
```

Constructs a set of **UV** texture coordinates from the given vector.

Parameters

| | | |
|----|---|------------------------------------|
| in | v | A reference to the vector to copy. |
|----|---|------------------------------------|

5.119.2.6 UV() [6/6]

```
mage::UV::UV (
    XMFLOAT2 && v ) [explicit]
```

Constructs a set of **UV** texture coordinates by moving the given vector.

Parameters

| | | |
|----|---|------------------------------------|
| in | v | A reference to the vector to move. |
|----|---|------------------------------------|

5.119.2.7 ~UV()

```
mage::UV::~UV ( ) [default]
```

Destructs this set of **UV** texture coordinates.

5.119.3 Member Function Documentation

5.119.3.1 operator=() [1/2]

```
UV& mage::UV::operator= (
    const UV & uv )
```

Copies the given set of **UV** texture coordinates to this set of texture coordinates.

Parameters

| | | |
|----|----|--|
| in | uv | A reference to the set of UV texture coordinates to copy. |
|----|----|--|

Returns

A reference to the copy of the given set of **UV** texture coordinates (i.e. this set of **UV** texture coordinates).

5.119.3.2 operator=() [2/2]

```
UV& mage::UV::operator= (
    UV && uv )
```

Moves the given set of `UV` texture coordinates to this set of texture coordinates.

Parameters

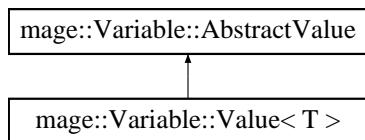
| | | |
|----|-----------------|--|
| in | <code>uv</code> | A reference to the set of <code>UV</code> texture coordinates to move. |
|----|-----------------|--|

Returns

A reference to the moved set of `UV` texture coordinates (i.e. this set of `UV` texture coordinates).

5.120 mage::Variable::Value< T > Struct Template Reference

Inheritance diagram for `mage::Variable::Value< T >`:



Public Member Functions

- `Value (const T &value)`
- `Value (const Value &value)=default`
- `Value (Value &&value)=default`
- `virtual ~Value ()=default`
- `Value & operator= (const Value &value)=delete`
- `Value & operator= (Value &&value)=delete`
- `virtual Value * Clone () const`
- `virtual const void * GetValue () const override`

Private Attributes

- `const T m_value`

Additional Inherited Members

5.120.1 Detailed Description

```
template<typename T>
struct mage::Variable::Value< T >
```

A struct of immutable values.

Template Parameters

| | |
|----------|------------------------|
| <i>T</i> | The type of the value. |
|----------|------------------------|

5.120.2 Constructor & Destructor Documentation**5.120.2.1 Value() [1/3]**

```
template<typename T >
mage::Variable::Value< T >::Value (
    const T & value ) [explicit]
```

Constructs a value.

Parameters

| | | |
|-----------|--------------|---------------------------|
| <i>in</i> | <i>value</i> | A reference to the value. |
|-----------|--------------|---------------------------|

5.120.2.2 Value() [2/3]

```
template<typename T >
mage::Variable::Value< T >::Value (
    const Value< T > & value ) [default]
```

Constructs a value from the given value.

Parameters

| | | |
|-----------|--------------|-----------------------------------|
| <i>in</i> | <i>value</i> | A reference to the value to copy. |
|-----------|--------------|-----------------------------------|

5.120.2.3 Value() [3/3]

```
template<typename T >
mage::Variable::Value< T >::Value (
    Value< T > && value ) [default]
```

Constructs a value by moving the given value.

Parameters

| | | |
|-----------|--------------|-----------------------------------|
| <i>in</i> | <i>value</i> | A reference to the value to move. |
|-----------|--------------|-----------------------------------|

5.120.2.4 ~Value()

```
template<typename T >
virtual mage::Variable::Value< T >::~Value ( ) [virtual], [default]
```

Destructs this value.

5.120.3 Member Function Documentation

5.120.3.1 Clone()

```
template<typename T >
virtual Value* mage::Variable::Value< T >::Clone ( ) const [virtual]
```

Clones this value.

Returns

A pointer to a clone of this value.

Implements [mage::Variable::AbstractValue](#).

5.120.3.2 GetValue()

```
template<typename T >
virtual const void* mage::Variable::Value< T >::GetValue ( ) const [override], [virtual]
```

Returns the value of this value.

Returns

A pointer to the value of this value.

Implements [mage::Variable::AbstractValue](#).

5.120.3.3 operator=() [1/2]

```
template<typename T >
Value& mage::Variable::Value< T >::operator= (
    const Value< T > & value) [delete]
```

Copies the given value to this value.

Parameters

| | | |
|----|--------------|-----------------------------------|
| in | <i>value</i> | A reference to the value to copy. |
|----|--------------|-----------------------------------|

Returns

A reference to the copy of the given value (i.e. this value).

5.120.3.4 operator=() [2/2]

```
template<typename T >
Value& mage::Variable::Value< T >::operator= (
    Value< T > && value ) [delete]
```

Moves the given value to this value.

Parameters

| | | |
|----|-------|-----------------------------------|
| in | value | A reference to the value to move. |
|----|-------|-----------------------------------|

Returns

A reference to the moved value (i.e. this value).

5.120.4 Member Data Documentation

5.120.4.1 m_value

```
template<typename T >
const T mage::Variable::Value< T >::m_value [private]
```

The value of this value.

5.121 mage::Variable Struct Reference

```
#include <variable.hpp>
```

Classes

- struct [AbstractValue](#)
- struct [Value](#)

Public Member Functions

- template<typename T >
[Variable](#) ([VariableType](#) type, const string &name, const T &value)
- [Variable](#) (const [Variable](#) &variable)
- [Variable](#) ([Variable](#) &&variable)=default
- [~Variable](#) ()=default
- [Variable](#) & [operator=](#) (const [Variable](#) &variable)=default
- [Variable](#) & [operator=](#) ([Variable](#) &&variable)=default
- [VariableType](#) [GetType](#) () const
- const string & [GetName](#) () const
- const void * [GetValue](#) () const
- template<typename T >
void [SetValue](#) (const T &value)

Private Attributes

- const `VariableType m_type`
- const string `m_name`
- `UniquePtr<const AbstractValue> m_value`

5.121.1 Detailed Description

A struct of (immutable) variables.

5.121.2 Constructor & Destructor Documentation

5.121.2.1 Variable() [1/3]

```
template<typename T >
mage::Variable::Variable (
    VariableType type,
    const string & name,
    const T & value )
```

Constructs a variable.

Template Parameters

| | |
|----------|----------------------------------|
| <i>T</i> | The (storage) type of the value. |
|----------|----------------------------------|

Parameters

| | | |
|----|--------------|------------------------------------|
| in | <i>type</i> | The (scripting) type of the value. |
| in | <i>name</i> | The name. |
| in | <i>value</i> | A reference to the value. |

5.121.2.2 Variable() [2/3]

```
mage::Variable::Variable (
    const Variable & variable )
```

Constructs a variable from the given variable.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>variable</i> | A reference to the variable to copy. |
|----|-----------------|--------------------------------------|

5.121.2.3 Variable() [3/3]

```
mage::Variable::Variable (
```

```
Variable && variable ) [default]
```

Constructs a variable by moving the given variable.

Parameters

| | | |
|----|----------|--------------------------------------|
| in | variable | A reference to the variable to move. |
|----|----------|--------------------------------------|

5.121.2.4 ~Variable()

```
mage::Variable::~Variable ( ) [default]
```

Destructs this variable.

5.121.3 Member Function Documentation

5.121.3.1 GetName()

```
const string& mage::Variable::GetName ( ) const
```

Returns the name of this variable.

Returns

A reference to the name of this variable.

5.121.3.2 GetType()

```
VariableType mage::Variable::GetType ( ) const
```

Returns the scripting type of this value.

Returns

The type of this value.

5.121.3.3 GetValue()

```
const void* mage::Variable::GetValue ( ) const
```

Returns the value of this variable.

Returns

A pointer to the value of this variable.

5.121.3.4 operator=() [1/2]

```
Variable& mage::Variable::operator= (
    const Variable & variable ) [default]
```

Copies the given variable to this variable.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>variable</i> | A reference to the variable to copy. |
|----|-----------------|--------------------------------------|

Returns

A reference to the copy of the given variable (i.e. this variable).

5.121.3.5 operator=() [2/2]

```
Variable& mage::Variable::operator= (
    Variable && variable ) [default]
```

Moves the given variable to this variable.

Parameters

| | | |
|----|-----------------|--------------------------------------|
| in | <i>variable</i> | A reference to the variable to copy. |
|----|-----------------|--------------------------------------|

Returns

A reference to the moved variable (i.e. this variable).

5.121.3.6 SetValue()

```
template<typename T >
void mage::Variable::SetValue (
    const T & value )
```

Sets the value of this variable.

Template Parameters

| | |
|----------|----------------------------------|
| <i>T</i> | The (storage) type of the value. |
|----------|----------------------------------|

Parameters

| | | |
|----|--------------|---------------------------|
| in | <i>value</i> | A reference to the value. |
|----|--------------|---------------------------|

5.121.4 Member Data Documentation**5.121.4.1 m_name**

```
const string mage::Variable::m_name [private]
```

The name of this variable.

5.121.4.2 m_type

```
const VariableType mage::Variable::m_type [private]
```

The type of this value.

Note

It is not possible to use typeid(T).name() since this assumes a bijection between the scripting types and the storage types, which is not the case. Thus the type needs to be stored explicitly.

5.121.4.3 m_value

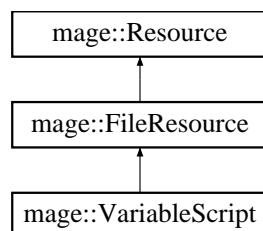
```
UniquePtr< const AbstractValue > mage::Variable::m_value [private]
```

A pointer to the value of this variable.

5.122 mage::VariableScript Class Reference

```
#include <variable_script.hpp>
```

Inheritance diagram for mage::VariableScript:



Public Member Functions

- [VariableScript](#) (const wstring &fname, bool import=true)
- [VariableScript](#) (const [VariableScript](#) &variable_script)=delete
- [VariableScript](#) ([VariableScript](#) &&variable_script)
- virtual ~[VariableScript](#) ()
- [VariableScript](#) & [operator=](#) (const [VariableScript](#) &variable_script)=delete
- [VariableScript](#) & [operator=](#) ([VariableScript](#) &&variable_script)=delete
- void [ImportScript](#) (const wstring &fname=L"")
- void [ExportScript](#) (const wstring &fname=L"")
- bool [IsEmpty](#) () const
- size_t [GetNumberOfVariables](#) () const
- template<typename T >
 void [AddVariable](#) ([VariableType](#) type, const string &name, const T &value)
- void [RemoveVariable](#) (const string &name)
- void [RemoveAllVariables](#) ()
- template<typename T >
 const T * [GetValueOfVariable](#) (const string &name) const
- template<typename T >
 void [SetValueOfVariable](#) (const string &name, const T &value)

Private Attributes

- map< string, Variable > m_variables

5.122.1 Detailed Description

A class of variable scripts.

5.122.2 Constructor & Destructor Documentation

5.122.2.1 VariableScript() [1/3]

```
mage::VariableScript::VariableScript (
    const wstring & fname,
    bool import = true ) [explicit]
```

Constructs a variable script.

Parameters

| | | |
|----|---------------|---|
| in | <i>fname</i> | A reference to the filename of the variable script. |
| in | <i>import</i> | Flag indicating whether the variables of the variable script need to be imported. |

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to import the variable script from file (only possible if <i>import</i> is equal to <code>true</code>). |
|---------------------------|---|

5.122.2.2 VariableScript() [2/3]

```
mage::VariableScript::VariableScript (
    const VariableScript & variable_script ) [delete]
```

Constructs a variable script from the given variable script.

Parameters

| | | |
|----|------------------------|---|
| in | <i>variable_script</i> | A reference to the variable script to copy. |
|----|------------------------|---|

5.122.2.3 VariableScript() [3/3]

```
mage::VariableScript::VariableScript (
    VariableScript && variable_script ) [default]
```

Constructs a variable script by moving the given variable script.

Parameters

| | | |
|----|------------------------|---|
| in | <i>variable_script</i> | A reference to the variable script to move. |
|----|------------------------|---|

5.122.2.4 ~VariableScript()

```
mage::VariableScript::~VariableScript ( ) [virtual]
```

Destruct this variable script.

5.122.3 Member Function Documentation**5.122.3.1 AddVariable()**

```
template<typename T >
void mage::VariableScript::AddVariable (
    VariableType type,
    const string & name,
    const T & value )
```

Adds the given variable to this variable script.

Precondition

No variable with the name *name* exist in this variable script.

Template Parameters

| | |
|---|----------------------------------|
| T | The (storage) type of the value. |
|---|----------------------------------|

Parameters

| | | |
|----|--------------|---|
| in | <i>type</i> | The (scripting) type of the variable. |
| in | <i>type</i> | The type of the variable. |
| in | <i>name</i> | The name of the variable. |
| in | <i>value</i> | A reference to the value of the variable. |

5.122.3.2 ExportScript()

```
void mage::VariableScript::ExportScript (
    const wstring & fname = L"" )
```

Exports this variable script to the file with the given filename. If the filename is not specified the associated filename of this variable script is used.

Parameters

| | | |
|----|--------------|------------------------------|
| in | <i>fname</i> | A reference to the filename. |
|----|--------------|------------------------------|

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to export the variable script to file. |
|---------------------------|---|

5.122.3.3 GetNumberOfVariables()

```
size_t mage::VariableScript::GetNumberOfVariables ( ) const
```

Returns the number of variables in this variable script.

Returns

The number of variables in this variable script.

5.122.3.4 GetValueOfVariable()

```
template<typename T >
const T* mage::VariableScript::GetValueOfVariable (
    const string & name ) const
```

Returns the value of the given variable in this variable script.

Template Parameters

| | |
|----------|----------------------------------|
| <i>T</i> | The (storage) type of the value. |
|----------|----------------------------------|

Parameters

| | | |
|----|-------------|---------------------------|
| in | <i>name</i> | The name of the variable. |
|----|-------------|---------------------------|

Returns

`nullptr` if no variable with the name *name* exists in this variable script.
A pointer to the value of the variable.

5.122.3.5 ImportScript()

```
void mage::VariableScript::ImportScript (
    const wstring & fname = L"" )
```

Imports this variable script from the file with the given filename. If the filename is not specified the associated filename of this variable script is used.

Parameters

| | | |
|----|--------------|------------------------------|
| in | <i>fname</i> | A reference to the filename. |
|----|--------------|------------------------------|

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to import the variable script from file. |
|---------------------------|---|

5.122.3.6 IsEmpty()

```
bool mage::VariableScript::IsEmpty() const
```

Checks whether this variable script is empty.

Returns

`true` if this variable script is empty. `false` otherwise.

5.122.3.7 operator=() [1/2]

```
VariableScript& mage::VariableScript::operator= (
    const VariableScript & variable_script ) [delete]
```

Copies the given variable script to this variable script.

Parameters

| | | |
|----|------------------------|---|
| in | <i>variable_script</i> | A reference to the variable script to copy. |
|----|------------------------|---|

Returns

A reference to the copy of the given variable script (i.e. this variable script).

5.122.3.8 operator=() [2/2]

```
VariableScript& mage::VariableScript::operator= (
    VariableScript && variable_script ) [delete]
```

Moves the given variable script to this variable script.

Parameters

| | | |
|----|------------------------|---|
| in | <i>variable_script</i> | A reference to the variable script to move. |
|----|------------------------|---|

Returns

A reference to the moved variable script (i.e. this variable script).

5.122.3.9 RemoveAllVariables()

```
void mage::VariableScript::RemoveAllVariables ( )
```

Removes all variables from this variable script.

5.122.3.10 RemoveVariable()

```
void mage::VariableScript::RemoveVariable (
    const string & name )
```

Removes the given variable from this variable script.

Parameters

| | | |
|-----------------|-------------------|---------------------------|
| <code>in</code> | <code>name</code> | The name of the variable. |
|-----------------|-------------------|---------------------------|

5.122.3.11 SetValueOfVariable()

```
template<typename T >
void mage::VariableScript::SetValueOfVariable (
    const string & name,
    const T & value )
```

Sets the value of the given variable in this variable script.

Template Parameters

| | |
|----------------|----------------------------------|
| <code>T</code> | The (storage) type of the value. |
|----------------|----------------------------------|

Parameters

| | | |
|-----------------|--------------------|---|
| <code>in</code> | <code>name</code> | The name of the variable. |
| <code>in</code> | <code>value</code> | A reference to the value of the variable. |

Note

Nothing happens if no variable with the name `name` exists in this variable script.

5.122.4 Member Data Documentation**5.122.4.1 m_variables**

```
map< string, Variable > mage::VariableScript::m_variables [private]
```

A map containing the variables in this variable script

The keys match the variables' name and the values match the variables.

5.123 mage::VertexPosition Struct Reference

```
#include <vertex.hpp>
```

Public Member Functions

- `VertexPosition ()=default`
- `VertexPosition (const Point3 &p)`
- `VertexPosition (const VertexPosition &vertex)=default`
- `VertexPosition (VertexPosition &&vertex)=default`
- `~VertexPosition ()=default`
- `VertexPosition & operator= (const VertexPosition &vertex)=default`
- `VertexPosition & operator= (VertexPosition &&vertex)=default`

Public Attributes

- `Point3 p`

Static Public Attributes

- `static const uint32_t nb_input_elements = 1`
- `static const D3D11_INPUT_ELEMENT_DESC input_element_desc [nb_input_elements]`

5.123.1 Detailed Description

A struct of vertices containing position coordinates.

5.123.2 Constructor & Destructor Documentation

5.123.2.1 `VertexPosition()` [1/4]

```
mage::VertexPosition::VertexPosition ( ) [default]
```

Constructs a vertex.

5.123.2.2 `VertexPosition()` [2/4]

```
mage::VertexPosition::VertexPosition ( const Point3 & p ) [explicit]
```

Constructs a vertex.

Parameters

| | | |
|----|----------|--|
| in | <i>p</i> | A reference to the position of the vertex. |
|----|----------|--|

5.123.2.3 VertexPosition() [3/4]

```
mage::VertexPosition::VertexPosition (
    const VertexPosition & vertex ) [default]
```

Constructs a vertex from the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

5.123.2.4 VertexPosition() [4/4]

```
mage::VertexPosition::VertexPosition (
    VertexPosition && vertex ) [default]
```

Constructs a vertex by moving the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to move. |
|----|---------------|------------------------------------|

5.123.2.5 ~VertexPosition()

```
mage::VertexPosition::~VertexPosition ( ) [default]
```

Destructs this vertex.

5.123.3 Member Function Documentation**5.123.3.1 operator=() [1/2]**

```
VertexPosition& mage::VertexPosition::operator= (
    const VertexPosition & vertex ) [default]
```

Copies the given vertex to this vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

Returns

A reference to the copy of the given vertex (i.e. this vertex).

5.123.3.2 operator=() [2/2]

```
VertexPosition& mage::VertexPosition::operator= (
    VertexPosition && vertex ) [default]
```

Moves the given vertex to this vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to move. |
|----|--------|------------------------------------|

Returns

A reference to the moved vertex (i.e. this vertex).

5.123.4 Member Data Documentation**5.123.4.1 input_element_desc**

```
const D3D11_INPUT_ELEMENT_DESC mage::VertexPosition::input_element_desc [static]
```

Initial value:

```
= {
    { MAGE_VERTEX_SEMANTIC_NAME_POSITION, 0, DXGI_FORMAT_R32G32B32_FLOAT,      0,
        D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 }
}
```

The input element descriptor of a vertex.

5.123.4.2 nb_input_elements

```
const uint32_t mage::VertexPosition::nb_input_elements = 1 [static]
```

The number of elements in the input element descriptor of a vertex.

5.123.4.3 p

```
Point3 mage::VertexPosition::p
```

The position of this vertex.

5.124 mage::VertexPositionColor Struct Reference

```
#include <vertex.hpp>
```

Public Member Functions

- `VertexPositionColor ()=default`
- `VertexPositionColor (const Point3 &p, const Color &c)`
- `VertexPositionColor (const VertexPositionColor &vertex)=default`
- `VertexPositionColor (VertexPositionColor &&vertex)=default`
- `~VertexPositionColor ()=default`
- `VertexPositionColor & operator= (const VertexPositionColor &vertex)=default`
- `VertexPositionColor & operator= (VertexPositionColor &&vertex)=default`

Public Attributes

- `Point3 p`
- `Color c`

Static Public Attributes

- `static const uint32_t nb_input_elements = 2`
- `static const D3D11_INPUT_ELEMENT_DESC input_element_desc [nb_input_elements]`

5.124.1 Detailed Description

A struct of vertices containing position coordinates and a color.

5.124.2 Constructor & Destructor Documentation

5.124.2.1 VertexPositionColor() [1/4]

```
mage::VertexPositionColor::VertexPositionColor ( ) [default]
```

Constructs a vertex.

5.124.2.2 VertexPositionColor() [2/4]

```
mage::VertexPositionColor::VertexPositionColor (
    const Point3 &p,
    const Color &c ) [explicit]
```

Constructs a vertex.

Parameters

| | | |
|----|----------|--|
| in | <i>p</i> | A reference to the position of the vertex. |
| in | <i>c</i> | A reference to the color of the vertex. |

5.124.2.3 VertexPositionColor() [3/4]

```
mage::VertexPositionColor::VertexPositionColor (
    const VertexPositionColor & vertex ) [default]
```

Constructs a vertex from the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

5.124.2.4 VertexPositionColor() [4/4]

```
mage::VertexPositionColor::VertexPositionColor (
    VertexPositionColor && vertex ) [default]
```

Constructs a vertex by moving the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to move. |
|----|---------------|------------------------------------|

5.124.2.5 ~VertexPositionColor()

```
mage::VertexPositionColor::~VertexPositionColor ( ) [default]
```

Destructs this vertex.

5.124.3 Member Function Documentation**5.124.3.1 operator=() [1/2]**

```
VertexPositionColor& mage::VertexPositionColor::operator= (
    const VertexPositionColor & vertex ) [default]
```

Copies the given vertex to this vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

Returns

A reference to the copy of the given vertex (i.e. this vertex).

5.124.3.2 operator=() [2/2]

```
VertexPositionColor& mage::VertexPositionColor::operator= (
    VertexPositionColor && vertex ) [default]
```

Moves the given vertex to this vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to move. |
|----|--------|------------------------------------|

Returns

A reference to the moved vertex (i.e. this vertex).

5.124.4 Member Data Documentation**5.124.4.1 c**

```
Color mage::VertexPositionColor::c
```

The color of this vertex.

5.124.4.2 input_element_desc

```
const D3D11_INPUT_ELEMENT_DESC mage::VertexPositionColor::input_element_desc [static]
```

Initial value:

```
= {
    { MAGE_VERTEX_SEMANTIC_NAME_POSITION, 0, DXGI_FORMAT_R32G32B32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_COLOR, 0, DXGI_FORMAT_R32G32B32A32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 }
}
```

The input element descriptor of a vertex.

5.124.4.3 nb_input_elements

```
const uint32_t mage::VertexPositionColor::nb_input_elements = 2 [static]
```

The number of elements in the input element descriptor of a vertex.

5.124.4.4 p

`Point3` `mage::VertexPositionColor::p`

The position of this vertex.

5.125 mage::VertexPositionColorTexture Struct Reference

```
#include <vertex.hpp>
```

Public Member Functions

- `VertexPositionColorTexture ()=default`
- `VertexPositionColorTexture (const Point3 &p, const Color &c, const UV &tex)`
- `VertexPositionColorTexture (const VertexPositionColorTexture &vertex)=default`
- `VertexPositionColorTexture (VertexPositionColorTexture &&vertex)=default`
- `~VertexPositionColorTexture ()=default`
- `VertexPositionColorTexture & operator= (const VertexPositionColorTexture &vertex)=default`
- `VertexPositionColorTexture & operator= (VertexPositionColorTexture &&vertex)=default`

Public Attributes

- `Point3 p`
- `Color c`
- `UV tex`

Static Public Attributes

- `static const uint32_t nb_input_elements = 3`
- `static const D3D11_INPUT_ELEMENT_DESC input_element_desc [nb_input_elements]`

5.125.1 Detailed Description

A struct of vertices containing position and texture coordinates and a color.

5.125.2 Constructor & Destructor Documentation

5.125.2.1 VertexPositionColorTexture() [1/4]

```
mage::VertexPositionColorTexture::VertexPositionColorTexture ( ) [default]
```

Constructs a vertex.

5.125.2.2 VertexPositionColorTexture() [2/4]

```
mage::VertexPositionColorTexture::VertexPositionColorTexture ( 
    const Point3 & p,
    const Color & c,
    const UV & tex ) [explicit]
```

Constructs a vertex.

Parameters

| | | |
|----|------------|---|
| in | <i>p</i> | A reference to the position of the vertex. |
| in | <i>c</i> | A reference to the color of the vertex. |
| in | <i>tex</i> | A reference to the texture coordinates of the vertex. |

5.125.2.3 VertexPositionColorTexture() [3/4]

```
mage::VertexPositionColorTexture::VertexPositionColorTexture (
    const VertexPositionColorTexture & vertex ) [default]
```

Constructs a vertex from the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

5.125.2.4 VertexPositionColorTexture() [4/4]

```
mage::VertexPositionColorTexture::VertexPositionColorTexture (
    VertexPositionColorTexture && vertex ) [default]
```

Constructs a vertex by moving the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to move. |
|----|---------------|------------------------------------|

5.125.2.5 ~VertexPositionColorTexture()

```
mage::VertexPositionColorTexture::~VertexPositionColorTexture () [default]
```

Destructs this vertex.

5.125.3 Member Function Documentation**5.125.3.1 operator=()** [1/2]

```
VertexPositionColorTexture& mage::VertexPositionColorTexture::operator= (
    const VertexPositionColorTexture & vertex ) [default]
```

Copies the given vertex to this vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

Returns

A reference to the copy of the given vertex (i.e. this vertex).

5.125.3.2 operator=() [2/2]

```
VertexPositionColorTexture& mage::VertexPositionColorTexture::operator= (
    VertexPositionColorTexture && vertex ) [default]
```

Moves the given vertex to this vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to move. |
|----|--------|------------------------------------|

Returns

A reference to the moved vertex (i.e. this vertex).

5.125.4 Member Data Documentation**5.125.4.1 c**

```
Color mage::VertexPositionColorTexture::c
```

The color of this vertex.

5.125.4.2 input_element_desc

```
const D3D11_INPUT_ELEMENT_DESC mage::VertexPositionColorTexture::input_element_desc [static]
```

Initial value:

```
= {
    { MAGE_VERTEX_SEMANTIC_NAME_POSITION, 0, DXGI_FORMAT_R32G32B32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_COLOR, 0, DXGI_FORMAT_R32G32B32A32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_TEXTURE, 0, DXGI_FORMAT_R32G32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 }
}
```

The input element descriptor of a vertex.

5.125.4.3 nb_input_elements

```
const uint32_t mage::VertexPositionColorTexture::nb_input_elements = 3 [static]
```

The number of elements in the input element descriptor of a vertex.

5.125.4.4 p

`Point3 mage::VertexPositionColorTexture::p`

The position of this vertex.

5.125.4.5 tex

`UV mage::VertexPositionColorTexture::tex`

The texture coordinates of this vertex.

5.126 mage::VertexPositionNormal Struct Reference

```
#include <vertex.hpp>
```

Public Member Functions

- `VertexPositionNormal ()=default`
- `VertexPositionNormal (const Point3 &p, const Normal3 &n)`
- `VertexPositionNormal (const VertexPositionNormal &vertex)=default`
- `VertexPositionNormal (VertexPositionNormal &&vertex)=default`
- `~VertexPositionNormal ()=default`
- `VertexPositionNormal & operator= (const VertexPositionNormal &vertex)=default`
- `VertexPositionNormal & operator= (VertexPositionNormal &&vertex)=default`

Public Attributes

- `Point3 p`
- `Normal3 n`

Static Public Attributes

- `static const uint32_t nb_input_elements = 2`
- `static const D3D11_INPUT_ELEMENT_DESC input_element_desc [nb_input_elements]`

5.126.1 Detailed Description

A struct of vertices containing position and normal coordinates.

5.126.2 Constructor & Destructor Documentation

5.126.2.1 VertexPositionNormal() [1/4]

`mage::VertexPositionNormal::VertexPositionNormal () [default]`

Constructs a vertex.

5.126.2.2 VertexPositionNormal() [2/4]

```
mage::VertexPositionNormal::VertexPositionNormal (
    const Point3 & p,
    const Normal3 & n ) [explicit]
```

Constructs a vertex.

Parameters

| | | |
|----|----------|--|
| in | <i>p</i> | A reference to the position of the vertex. |
| in | <i>n</i> | A reference to the normal of the vertex. |

5.126.2.3 VertexPositionNormal() [3/4]

```
mage::VertexPositionNormal::VertexPositionNormal (
    const VertexPositionNormal & vertex ) [default]
```

Constructs a vertex from the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

5.126.2.4 VertexPositionNormal() [4/4]

```
mage::VertexPositionNormal::VertexPositionNormal (
    VertexPositionNormal && vertex ) [default]
```

Constructs a vertex by moving the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to move. |
|----|---------------|------------------------------------|

5.126.2.5 ~VertexPositionNormal()

```
mage::VertexPositionNormal::~VertexPositionNormal ( ) [default]
```

Destructs this vertex.

5.126.3 Member Function Documentation**5.126.3.1 operator=() [1/2]**

```
VertexPositionNormal& mage::VertexPositionNormal::operator= (
    const VertexPositionNormal & vertex ) [default]
```

Copies the given vertex to this vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

Returns

A reference to the copy of the given vertex (i.e. this vertex).

5.126.3.2 operator=() [2/2]

```
VertexPositionNormal& mage::VertexPositionNormal::operator= (
    VertexPositionNormal && vertex ) [default]
```

Moves the given vertex to this vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to move. |
|----|--------|------------------------------------|

Returns

A reference to the moved vertex (i.e. this vertex).

5.126.4 Member Data Documentation**5.126.4.1 input_element_desc**

```
const D3D11_INPUT_ELEMENT_DESC mage::VertexPositionNormal::input_element_desc [static]
```

Initial value:

```
= {
    { MAGE_VERTEX_SEMANTIC_NAME_POSITION, 0, DXGI_FORMAT_R32G32B32_FLOAT,      0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_NORMAL, 0, DXGI_FORMAT_R32G32B32_FLOAT,      0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 }
}
```

The input element descriptor of a vertex.

5.126.4.2 n

```
Normal3 mage::VertexPositionNormal::n
```

The normal of this vertex.

5.126.4.3 nb_input_elements

```
const uint32_t mage::VertexPositionNormal::nb_input_elements = 2 [static]
```

The number of elements in the input element descriptor of a vertex.

5.126.4.4 p

`Point3` `mage::VertexPositionNormal::p`

The position of this vertex.

5.127 mage::VertexPositionNormalColor Struct Reference

```
#include <vertex.hpp>
```

Public Member Functions

- `VertexPositionNormalColor ()=default`
- `VertexPositionNormalColor (const Point3 &p, const Normal3 &n, const Color &c)`
- `VertexPositionNormalColor (const VertexPositionNormalColor &vertex)=default`
- `VertexPositionNormalColor (VertexPositionNormalColor &&vertex)=default`
- `~VertexPositionNormalColor ()=default`
- `VertexPositionNormalColor & operator= (const VertexPositionNormalColor &vertex)=default`
- `VertexPositionNormalColor & operator= (VertexPositionNormalColor &&vertex)=default`

Public Attributes

- `Point3 p`
- `Normal3 n`
- `Color c`

Static Public Attributes

- `static const uint32_t nb_input_elements = 3`
- `static const D3D11_INPUT_ELEMENT_DESC input_element_desc [nb_input_elements]`

5.127.1 Detailed Description

A struct of vertices containing position and normal coordinates and a color.

5.127.2 Constructor & Destructor Documentation

5.127.2.1 VertexPositionNormalColor() [1/4]

```
mage::VertexPositionNormalColor::VertexPositionNormalColor ( ) [default]
```

Constructs a vertex.

5.127.2.2 VertexPositionNormalColor() [2/4]

```
mage::VertexPositionNormalColor::VertexPositionNormalColor (
    const Point3 & p,
    const Normal3 & n,
    const Color & c ) [explicit]
```

Constructs a vertex.

Parameters

| | | |
|----|----------|--|
| in | <i>p</i> | A reference to the position of the vertex. |
| in | <i>n</i> | A reference to the normal of the vertex. |
| in | <i>c</i> | A reference to the color of the vertex. |

5.127.2.3 VertexPositionNormalColor() [3/4]

```
mage::VertexPositionNormalColor::VertexPositionNormalColor (
    const VertexPositionNormalColor & vertex ) [default]
```

Constructs a vertex from the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

5.127.2.4 VertexPositionNormalColor() [4/4]

```
mage::VertexPositionNormalColor::VertexPositionNormalColor (
    VertexPositionNormalColor && vertex ) [default]
```

Constructs a vertex by moving the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to move. |
|----|---------------|------------------------------------|

5.127.2.5 ~VertexPositionNormalColor()

```
mage::VertexPositionNormalColor::~VertexPositionNormalColor ( ) [default]
```

Destructs this vertex.

5.127.3 Member Function Documentation**5.127.3.1 operator=() [1/2]**

```
VertexPositionNormalColor& mage::VertexPositionNormalColor::operator= (
    const VertexPositionNormalColor & vertex ) [default]
```

Copies the given vertex to this vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

Returns

A reference to the copy of the given vertex (i.e. this vertex).

5.127.3.2 operator=() [2/2]

```
VertexPositionNormalColor& mage::VertexPositionNormalColor::operator= (
    VertexPositionNormalColor && vertex ) [default]
```

Moves the given vertex to this vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to move. |
|----|--------|------------------------------------|

Returns

A reference to the moved vertex (i.e. this vertex).

5.127.4 Member Data Documentation**5.127.4.1 c**

```
Color mage::VertexPositionNormalColor::c
```

The color of this vertex.

5.127.4.2 input_element_desc

```
const D3D11_INPUT_ELEMENT_DESC mage::VertexPositionNormalColor::input_element_desc [static]
```

Initial value:

```
= {
    { MAGE_VERTEX_SEMANTIC_NAME_POSITION, 0, DXGI_FORMAT_R32G32B32_FLOAT, 0,
        D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_NORMAL, 0, DXGI_FORMAT_R32G32B32_FLOAT, 0,
        D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_COLOR, 0, DXGI_FORMAT_R32G32B32A32_FLOAT, 0,
        D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 }
}
```

The input element descriptor of a vertex.

5.127.4.3 n

```
Normal3 mage::VertexPositionNormalColor::n
```

The normal of this vertex.

5.127.4.4 nb_input_elements

```
const uint32_t mage::VertexPositionNormalColor::nb_input_elements = 3 [static]
```

The number of elements in the input element descriptor of a vertex.

5.127.4.5 p

```
Point3 mage::VertexPositionNormalColor::p
```

The position of this vertex.

5.128 mage::VertexPositionNormalColorTexture Struct Reference

```
#include <vertex.hpp>
```

Public Member Functions

- `VertexPositionNormalColorTexture ()=default`
- `VertexPositionNormalColorTexture (const Point3 &p, const Normal3 &n, const Color &c, const UV &tex)`
- `VertexPositionNormalColorTexture (const VertexPositionNormalColorTexture &vertex)=default`
- `VertexPositionNormalColorTexture (VertexPositionNormalColorTexture &&vertex)=default`
- `~VertexPositionNormalColorTexture ()=default`
- `VertexPositionNormalColorTexture & operator= (const VertexPositionNormalColorTexture &vertex)=default`
- `VertexPositionNormalColorTexture & operator= (VertexPositionNormalColorTexture &&vertex)=default`

Public Attributes

- `Point3 p`
- `Normal3 n`
- `Color c`
- `UV tex`

Static Public Attributes

- `static const int nb_input_elements = 4`
- `static const D3D11_INPUT_ELEMENT_DESC input_element_desc [nb_input_elements]`

5.128.1 Detailed Description

A struct of vertices containing position, normal and texture coordinates and a color.

5.128.2 Constructor & Destructor Documentation

5.128.2.1 VertexPositionNormalColorTexture() [1/4]

```
mage::VertexPositionNormalColorTexture::VertexPositionNormalColorTexture ( ) [default]
```

Constructs a vertex.

5.128.2.2 VertexPositionNormalColorTexture() [2/4]

```
mage::VertexPositionNormalColorTexture::VertexPositionNormalColorTexture (
    const Point3 & p,
    const Normal3 & n,
    const Color & c,
    const UV & tex ) [explicit]
```

Constructs a vertex.

Parameters

| | | |
|----|------------|---|
| in | <i>p</i> | A reference to the position of the vertex. |
| in | <i>n</i> | A reference to the normal of the vertex. |
| in | <i>c</i> | A reference to the color of the vertex. |
| in | <i>tex</i> | A reference to the texture coordinates of the vertex. |

5.128.2.3 VertexPositionNormalColorTexture() [3/4]

```
mage::VertexPositionNormalColorTexture::VertexPositionNormalColorTexture (
    const VertexPositionNormalColorTexture & vertex ) [default]
```

Constructs a vertex from the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

5.128.2.4 VertexPositionNormalColorTexture() [4/4]

```
mage::VertexPositionNormalColorTexture::VertexPositionNormalColorTexture (
    VertexPositionNormalColorTexture && vertex ) [default]
```

Constructs a vertex by moving the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to move. |
|----|---------------|------------------------------------|

5.128.2.5 ~VertexPositionNormalColorTexture()

```
mage::VertexPositionNormalColorTexture::~VertexPositionNormalColorTexture() [default]
```

Destructs this vertex.

5.128.3 Member Function Documentation

5.128.3.1 operator=() [1/2]

```
VertexPositionNormalColorTexture& mage::VertexPositionNormalColorTexture::operator= (
    const VertexPositionNormalColorTexture & vertex) [default]
```

Copies the given vertex to this vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to copy. |
|----|--------|------------------------------------|

Returns

A reference to the copy of the given vertex (i.e. this vertex).

5.128.3.2 operator=() [2/2]

```
VertexPositionNormalColorTexture& mage::VertexPositionNormalColorTexture::operator= (
    VertexPositionNormalColorTexture && vertex) [default]
```

Moves the given vertex to this vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to move. |
|----|--------|------------------------------------|

Returns

A reference to the moved vertex (i.e. this vertex).

5.128.4 Member Data Documentation

5.128.4.1 c

```
Color mage::VertexPositionNormalColorTexture::c
```

The color of this vertex.

5.128.4.2 input_element_desc

```
const D3D11_INPUT_ELEMENT_DESC mage::VertexPositionNormalColorTexture::input_element_desc
[static]
```

Initial value:

```
= {
    { MAGE_VERTEX_SEMANTIC_NAME_POSITION, 0, DXGI_FORMAT_R32G32B32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_NORMAL, 0, DXGI_FORMAT_R32G32B32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_COLOR, 0, DXGI_FORMAT_R32G32B32A32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_TEXTURE, 0, DXGI_FORMAT_R32G32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 }
}
```

The input element descriptor of a vertex.

5.128.4.3 n

`Normal3` mage::VertexPositionNormalColorTexture::n

The normal of this vertex.

5.128.4.4 nb_input_elements

```
const int mage::VertexPositionNormalColorTexture::nb_input_elements = 4 [static]
```

The number of elements in the input element descriptor of a vertex.

5.128.4.5 p

`Point3` mage::VertexPositionNormalColorTexture::p

The position of this vertex.

5.128.4.6 tex

`UV` mage::VertexPositionNormalColorTexture::tex

The texture coordinates of this vertex.

5.129 mage::VertexPositionNormalTexture Struct Reference

```
#include <vertex.hpp>
```

Public Member Functions

- `VertexPositionNormalTexture ()=default`
- `VertexPositionNormalTexture (const Point3 &p, const Normal3 &n, const UV &tex)`
- `VertexPositionNormalTexture (const VertexPositionNormalTexture &vertex)=default`
- `VertexPositionNormalTexture (VertexPositionNormalTexture &&vertex)=default`
- `~VertexPositionNormalTexture ()=default`
- `VertexPositionNormalTexture & operator= (const VertexPositionNormalTexture &vertex)=default`
- `VertexPositionNormalTexture & operator= (VertexPositionNormalTexture &&vertex)=default`

Public Attributes

- `Point3 p`
- `Normal3 n`
- `UV tex`

Static Public Attributes

- `static const uint32_t nb_input_elements = 3`
- `static const D3D11_INPUT_ELEMENT_DESC input_element_desc [nb_input_elements]`

5.129.1 Detailed Description

A struct of vertices containing position, normal and texture coordinates.

5.129.2 Constructor & Destructor Documentation

5.129.2.1 VertexPositionNormalTexture() [1/4]

```
mage::VertexPositionNormalTexture::VertexPositionNormalTexture ( ) [default]
```

Constructs a vertex.

5.129.2.2 VertexPositionNormalTexture() [2/4]

```
mage::VertexPositionNormalTexture::VertexPositionNormalTexture (
    const Point3 &p,
    const Normal3 &n,
    const UV &tex ) [explicit]
```

Constructs a vertex.

Parameters

| | | |
|----|------------------|---|
| in | <code>p</code> | A reference to the position of the vertex. |
| in | <code>n</code> | A reference to the normal of the vertex. |
| in | <code>tex</code> | A reference to the texture coordinates of the vertex. |

5.129.2.3 VertexPositionNormalTexture() [3/4]

```
mage::VertexPositionNormalTexture::VertexPositionNormalTexture (
    const VertexPositionNormalTexture & vertex ) [default]
```

Constructs a vertex from the given vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to copy. |
|----|--------|------------------------------------|

5.129.2.4 VertexPositionNormalTexture() [4/4]

```
mage::VertexPositionNormalTexture::VertexPositionNormalTexture (
    VertexPositionNormalTexture && vertex ) [default]
```

Constructs a vertex by moving the given vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to move. |
|----|--------|------------------------------------|

5.129.2.5 ~VertexPositionNormalTexture()

```
mage::VertexPositionNormalTexture::~VertexPositionNormalTexture ( ) [default]
```

Destructs this vertex.

5.129.3 Member Function Documentation

5.129.3.1 operator=() [1/2]

```
VertexPositionNormalTexture& mage::VertexPositionNormalTexture::operator= (
    const VertexPositionNormalTexture & vertex ) [default]
```

Copies the given vertex to this vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to copy. |
|----|--------|------------------------------------|

Returns

A reference to the copy of the given vertex (i.e. this vertex).

5.129.3.2 operator=() [2/2]

```
VertexPositionNormalTexture& mage::VertexPositionNormalTexture::operator= (
    VertexPositionNormalTexture && vertex) [default]
```

Moves the given vertex to this vertex.

Parameters

| | | |
|----|---------------------|------------------------------------|
| in | <code>vertex</code> | A reference to the vertex to move. |
|----|---------------------|------------------------------------|

Returns

A reference to the moved vertex (i.e. this vertex).

5.129.4 Member Data Documentation

5.129.4.1 input_element_desc

```
const D3D11_INPUT_ELEMENT_DESC mage::VertexPositionNormalTexture::input_element_desc [static]
```

Initial value:

```
= {
    { MAGE_VERTEX_SEMANTIC_NAME_POSITION, 0, DXGI_FORMAT_R32G32B32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_NORMAL, 0, DXGI_FORMAT_R32G32B32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_TEXTURE, 0, DXGI_FORMAT_R32G32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 }
}
```

The input element descriptor of a vertex.

5.129.4.2 n

```
Normal3 mage::VertexPositionNormalTexture::n
```

The normal of this vertex.

5.129.4.3 nb_input_elements

```
const uint32_t mage::VertexPositionNormalTexture::nb_input_elements = 3 [static]
```

The number of elements in the input element descriptor of a vertex.

5.129.4.4 p

```
Point3 mage::VertexPositionNormalTexture::p
```

The position of this vertex.

5.129.4.5 tex

`UV` `mage::VertexPositionNormalTexture::tex`

The texture coordinates of this vertex.

5.130 mage::VertexPositionTexture Struct Reference

```
#include <vertex.hpp>
```

Public Member Functions

- `VertexPositionTexture ()=default`
- `VertexPositionTexture (const Point3 &p, const UV &tex)`
- `VertexPositionTexture (const VertexPositionTexture &vertex)=default`
- `VertexPositionTexture (VertexPositionTexture &&vertex)=default`
- `~VertexPositionTexture ()=default`
- `VertexPositionTexture & operator= (const VertexPositionTexture &vertex)=default`
- `VertexPositionTexture & operator= (VertexPositionTexture &&vertex)=default`

Public Attributes

- `Point3 p`
- `UV tex`

Static Public Attributes

- `static const uint32_t nb_input_elements = 2`
- `static const D3D11_INPUT_ELEMENT_DESC input_element_desc [nb_input_elements]`

5.130.1 Detailed Description

A struct of vertices containing position and texture coordinates.

5.130.2 Constructor & Destructor Documentation

5.130.2.1 VertexPositionTexture() [1/4]

```
mage::VertexPositionTexture::VertexPositionTexture ( ) [default]
```

Constructs a vertex.

5.130.2.2 VertexPositionTexture() [2/4]

```
mage::VertexPositionTexture::VertexPositionTexture (  
    const Point3 &p,
    const UV &tex ) [explicit]
```

Constructs a vertex.

Parameters

| | | |
|----|------------|---|
| in | <i>p</i> | A reference to the position of the vertex. |
| in | <i>tex</i> | A reference to the texture coordinates of the vertex. |

5.130.2.3 VertexPositionTexture() [3/4]

```
mage::VertexPositionTexture::VertexPositionTexture (
    const VertexPositionTexture & vertex ) [default]
```

Constructs a vertex from the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

5.130.2.4 VertexPositionTexture() [4/4]

```
mage::VertexPositionTexture::VertexPositionTexture (
    VertexPositionTexture && vertex ) [default]
```

Constructs a vertex by moving the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to move. |
|----|---------------|------------------------------------|

5.130.2.5 ~VertexPositionTexture()

```
mage::VertexPositionTexture::~VertexPositionTexture ( ) [default]
```

Destructs this vertex.

5.130.3 Member Function Documentation**5.130.3.1 operator=()** [1/2]

```
VertexPositionTexture& mage::VertexPositionTexture::operator= (
    const VertexPositionTexture & vertex ) [default]
```

Copies the given vertex to this vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

Returns

A reference to the copy of the given vertex (i.e. this vertex).

5.130.3.2 operator=() [2/2]

```
VertexPositionTexture& mage::VertexPositionTexture::operator= (
    VertexPositionTexture && vertex ) [default]
```

Moves the given vertex to this vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to move. |
|----|--------|------------------------------------|

Returns

A reference to the moved vertex (i.e. this vertex).

5.130.4 Member Data Documentation**5.130.4.1 input_element_desc**

```
const D3D11_INPUT_ELEMENT_DESC mage::VertexPositionTexture::input_element_desc [static]
```

Initial value:

```
= {
    { MAGE_VERTEX_SEMANTIC_NAME_POSITION, 0, DXGI_FORMAT_R32G32B32_FLOAT,      0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_TEXTURE, 0, DXGI_FORMAT_R32G32_FLOAT,          0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 }
}
```

The input element descriptor of a vertex.

5.130.4.2 nb_input_elements

```
const uint32_t mage::VertexPositionTexture::nb_input_elements = 2 [static]
```

The number of elements in the input element descriptor of a vertex.

5.130.4.3 p

```
Point3 mage::VertexPositionTexture::p
```

The position of this vertex.

5.130.4.4 tex

```
UV mage::VertexPositionTexture::tex
```

The texture coordinates of this vertex.

5.131 mage::VertexPositionTextureTexture Struct Reference

```
#include <vertex.hpp>
```

Public Member Functions

- `VertexPositionTextureTexture ()=default`
- `VertexPositionTextureTexture (const Point3 &p, const UV &tex1, const UV &tex2)`
- `VertexPositionTextureTexture (const VertexPositionTextureTexture &vertex)=default`
- `VertexPositionTextureTexture (VertexPositionTextureTexture &&vertex)=default`
- `~VertexPositionTextureTexture ()=default`
- `VertexPositionTextureTexture & operator= (const VertexPositionTextureTexture &vertex)=default`
- `VertexPositionTextureTexture & operator= (VertexPositionTextureTexture &&vertex)=default`

Public Attributes

- `Point3 p`
- `UV tex1`
- `UV tex2`

Static Public Attributes

- `static const int nb_input_elements = 3`
- `static const D3D11_INPUT_ELEMENT_DESC input_element_desc [nb_input_elements]`

5.131.1 Detailed Description

A struct of vertices containing position coordinates and two sets of texture coordinates.

5.131.2 Constructor & Destructor Documentation

5.131.2.1 VertexPositionTextureTexture() [1/4]

```
mage::VertexPositionTextureTexture::VertexPositionTextureTexture ( ) [default]
```

Constructs a vertex.

5.131.2.2 VertexPositionTextureTexture() [2/4]

```
mage::VertexPositionTextureTexture::VertexPositionTextureTexture (
    const Point3 &p,
    const UV &tex1,
    const UV &tex2) [explicit]
```

Constructs a vertex.

Parameters

| | | |
|----|-------------|--|
| in | <i>p</i> | A reference to the position of the vertex. |
| in | <i>tex1</i> | A reference to the first texture coordinates of the vertex. |
| in | <i>tex2</i> | A reference to the second texture coordinates of the vertex. |

5.131.2.3 VertexPositionTextureTexture() [3/4]

```
mage::VertexPositionTextureTexture::VertexPositionTextureTexture (
    const VertexPositionTextureTexture & vertex ) [default]
```

Constructs a vertex from the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

5.131.2.4 VertexPositionTextureTexture() [4/4]

```
mage::VertexPositionTextureTexture::VertexPositionTextureTexture (
    VertexPositionTextureTexture && vertex ) [default]
```

Constructs a vertex by moving the given vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to move. |
|----|---------------|------------------------------------|

5.131.2.5 ~VertexPositionTextureTexture()

```
mage::VertexPositionTextureTexture::~VertexPositionTextureTexture ( ) [default]
```

Destructs this vertex.

5.131.3 Member Function Documentation**5.131.3.1 operator=()** [1/2]

```
VertexPositionTextureTexture& mage::VertexPositionTextureTexture::operator= (
    const VertexPositionTextureTexture & vertex ) [default]
```

Copies the given vertex to this vertex.

Parameters

| | | |
|----|---------------|------------------------------------|
| in | <i>vertex</i> | A reference to the vertex to copy. |
|----|---------------|------------------------------------|

Returns

A reference to the copy of the given vertex (i.e. this vertex).

5.131.3.2 operator=() [2/2]

```
VertexPositionTextureTexture& mage::VertexPositionTextureTexture::operator= (
    VertexPositionTextureTexture && vertex ) [default]
```

Moves the given vertex to this vertex.

Parameters

| | | |
|----|--------|------------------------------------|
| in | vertex | A reference to the vertex to move. |
|----|--------|------------------------------------|

Returns

A reference to the moved vertex (i.e. this vertex).

5.131.4 Member Data Documentation**5.131.4.1 input_element_desc**

```
const D3D11_INPUT_ELEMENT_DESC mage::VertexPositionTextureTexture::input_element_desc [static]
```

Initial value:

```
= {
    { MAGE_VERTEX_SEMANTIC_NAME_POSITION, 0, DXGI_FORMAT_R32G32B32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_TEXTURE, 0, DXGI_FORMAT_R32G32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 },
    { MAGE_VERTEX_SEMANTIC_NAME_TEXTURE, 1, DXGI_FORMAT_R32G32_FLOAT, 0,
      D3D11_APPEND_ALIGNED_ELEMENT, D3D11_INPUT_PER_VERTEX_DATA, 0 }
}
```

The input element descriptor of a vertex.

5.131.4.2 nb_input_elements

```
const int mage::VertexPositionTextureTexture::nb_input_elements = 3 [static]
```

The number of elements in the input element descriptor of a vertex.

5.131.4.3 p

```
Point3 mage::VertexPositionTextureTexture::p
```

The position of this vertex.

5.131.4.4 tex1

UV mage::VertexPositionTextureTexture::tex1

The first texture coordinates of this vertex.

5.131.4.5 tex2

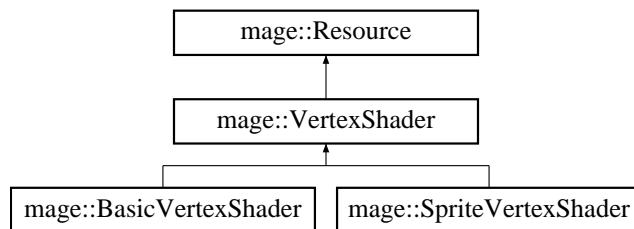
UV mage::VertexPositionTextureTexture::tex2

The second texture coordinates of this vertex.

5.132 mage::VertexShader Class Reference

```
#include <shader.hpp>
```

Inheritance diagram for mage::VertexShader:



Public Member Functions

- [VertexShader](#) (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const wstring &fname, const D3D11_INPUT_ELEMENT_DESC *input_element_desc, uint32_t nb_input_elements)
- [VertexShader](#) (ID3D11Device2 *device, ID3D11DeviceContext2 *device_context, const [CompiledVertexShader](#) &compiled_vertex_shader, const D3D11_INPUT_ELEMENT_DESC *input_element_desc, uint32_t nb_input_elements)
- [VertexShader](#) (const [VertexShader](#) &vertex_shader)=delete
- [VertexShader](#) ([VertexShader](#) &&vertex_shader)
- virtual ~[VertexShader](#) ()
- [VertexShader](#) & operator= (const [VertexShader](#) &vertex_shader)=delete
- [VertexShader](#) & operator= ([VertexShader](#) &&vertex_shader)=delete
- virtual void [PrepareShading](#) (ID3D11Buffer *transform) const

Protected Attributes

- ID3D11Device2 *const [m_device](#)
- ID3D11DeviceContext2 *const [m_device_context](#)
- [ComPtr< ID3D11VertexShader >](#) [m_vertex_shader](#)
- [ComPtr< ID3D11InputLayout >](#) [m_vertex_layout](#)

Private Member Functions

- void [SetupShader](#) (const D3D11_INPUT_ELEMENT_DESC **input_element_desc*, uint32_t *nb_input_elements*)
- void [SetupShader](#) (const CompiledVertexShader &*compiled_vertex_shader*, const D3D11_INPUT_ELEMENT_DESC **input_element_desc*, uint32_t *nb_input_elements*)

5.132.1 Detailed Description

A class of vertex shaders.

5.132.2 Constructor & Destructor Documentation

5.132.2.1 VertexShader() [1/4]

```
mage::VertexShader::VertexShader (
    ID3D11Device2 * device,
    ID3D11DeviceContext2 * device_context,
    const wstring & fname,
    const D3D11_INPUT_ELEMENT_DESC * input_element_desc,
    uint32_t nb_input_elements ) [explicit]
```

Constructs a vertex shader.

Precondition

device is not equal to nullptr.
device_context is not equal to nullptr.
input_element_desc is not equal to nullptr.
The array pointed to by *input_element_desc* contains *nb_input_elements* elements.

Parameters

| | | |
|----|---------------------------|---|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>fname</i> | A reference to the filename. |
| in | <i>input_element_desc</i> | A pointer the input element descriptors. |
| in | <i>nb_input_elements</i> | The number of elements contained in the given input element descriptor. |

Exceptions

| | |
|------------------------------------|--|
| FormattedException | Failed to initialize this vertex shader. |
|------------------------------------|--|

5.132.2.2 VertexShader() [2/4]

```
mage::VertexShader::VertexShader (
    ID3D11Device2 * device,
```

```
ID3D11DeviceContext2 * device_context,
const CompiledVertexShader & compiled_vertex_shader,
const D3D11_INPUT_ELEMENT_DESC * input_element_desc,
uint32_t nb_input_elements ) [explicit]
```

Constructs a vertex shader.

Precondition

device is not equal to `nullptr`.
device_context is not equal to `nullptr`.
input_element_desc is not equal to `nullptr`.
The array pointed to by *input_element_desc* contains *nb_input_elements* elements.

Parameters

| | | |
|----|-------------------------------|---|
| in | <i>device</i> | A pointer to the device. |
| in | <i>device_context</i> | A pointer to the device context. |
| in | <i>compiled_vertex_shader</i> | A reference to the compiled vertex shader. |
| in | <i>input_element_desc</i> | A pointer the input element descriptors. |
| in | <i>nb_input_elements</i> | The number of elements contained in the given input element descriptor. |

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to initialize this vertex shader. |
|---------------------------|--|

5.132.2.3 VertexShader() [3/4]

```
mage::VertexShader::VertexShader (
    const VertexShader & vertex_shader ) [delete]
```

Constructs a vertex shader from the given vertex shader.

Parameters

| | | |
|----|----------------------|---|
| in | <i>vertex_shader</i> | A reference to the vertex shader to copy. |
|----|----------------------|---|

5.132.2.4 VertexShader() [4/4]

```
mage::VertexShader::VertexShader (
    VertexShader && vertex_shader ) [default]
```

Constructs a vertex shader by moving the given vertex shader.

Parameters

| | | |
|----|----------------------|---|
| in | <i>vertex_shader</i> | A reference to the vertex shader to move. |
|----|----------------------|---|

5.132.2.5 ~VertexShader()

```
mage::VertexShader::~VertexShader ( ) [virtual], [default]
```

Destructs this vertex shader.

5.132.3 Member Function Documentation

5.132.3.1 operator=() [1/2]

```
VertexShader& mage::VertexShader::operator= (
    const VertexShader & vertex_shader ) [delete]
```

Copies the given vertex shader to this vertex shader.

Parameters

| | | |
|----|----------------------|---|
| in | <i>vertex_shader</i> | A reference to the vertex shader to copy. |
|----|----------------------|---|

Returns

A reference to the copy of the given vertex shader (i.e. this vertex shader).

5.132.3.2 operator=() [2/2]

```
VertexShader& mage::VertexShader::operator= (
    VertexShader && vertex_shader ) [delete]
```

Moves the given vertex shader to this vertex shader.

Parameters

| | | |
|----|----------------------|---|
| in | <i>vertex_shader</i> | A reference to the vertex shader to copy. |
|----|----------------------|---|

Returns

A reference to the moved vertex shader (i.e. this vertex shader).

5.132.3.3 PrepareShading()

```
void mage::VertexShader::PrepareShading (
    ID3D11Buffer * transform ) const [virtual]
```

Prepares this vertex shader for shading.

Precondition

transform is not equal to `nullptr`.

Parameters

| | | |
|----|------------------|------------------------------------|
| in | <i>transform</i> | A pointer to the transform buffer. |
|----|------------------|------------------------------------|

Reimplemented in [mage::BasicVertexShader](#), and [mage::SpriteVertexShader](#).

5.132.3.4 SetupShader() [1/2]

```
void mage::VertexShader::SetupShader (
    const D3D11_INPUT_ELEMENT_DESC * input_element_desc,
    uint32_t nb_input_elements ) [private]
```

Sets up this vertex shader (from compiled shader output).

Precondition

input_element_desc is not equal to `nullptr`.
The array pointed to by *input_element_desc* contains *nb_input_elements* elements.

Parameters

| | | |
|----|---------------------------|---|
| in | <i>input_element_desc</i> | A pointer the input element descriptors. |
| in | <i>nb_input_elements</i> | The number of elements contained in the given input element descriptor. |

Exceptions

| | |
|------------------------------------|-------------------------------------|
| FormattedException | Failed to setup this vertex shader. |
|------------------------------------|-------------------------------------|

5.132.3.5 SetupShader() [2/2]

```
void mage::VertexShader::SetupShader (
    const CompiledVertexShader & compiled_vertex_shader,
    const D3D11_INPUT_ELEMENT_DESC * input_element_desc,
    uint32_t nb_input_elements ) [private]
```

Sets up this vertex shader.

Precondition

input_element_desc is not equal to `nullptr`.
The array pointed to by *input_element_desc* contains *nb_input_elements* elements.

Parameters

| | | |
|----|-------------------------------|---|
| in | <i>compiled_vertex_shader</i> | A reference to the compiled vertex shader. |
| in | <i>input_element_desc</i> | A pointer the input element descriptors. |
| in | <i>nb_input_elements</i> | The number of elements contained in the given input element descriptor. |

Exceptions

| | |
|---------------------------|-------------------------------------|
| <i>FormattedException</i> | Failed to setup this vertex shader. |
|---------------------------|-------------------------------------|

5.132.4 Member Data Documentation

5.132.4.1 m_device

```
ID3D11Device2* const mage::VertexShader::m_device [protected]
```

A pointer to the device of this vertex shader.

5.132.4.2 m_device_context

```
ID3D11DeviceContext2* const mage::VertexShader::m_device_context [protected]
```

A pointer to the device context of this vertex shader.

5.132.4.3 m_vertex_layout

```
ComPtr< ID3D11InputLayout > mage::VertexShader::m_vertex_layout [protected]
```

A pointer to the input layout of this vertex shader.

5.132.4.4 m_vertex_shader

```
ComPtr< ID3D11VertexShader > mage::VertexShader::m_vertex_shader [protected]
```

A pointer to the vertex shader of this vertex shader.

5.133 mage::ViewFrustum Class Reference

```
#include <view_frustum.hpp>
```

Public Member Functions

- `ViewFrustum (const Camera &camera)`
- `ViewFrustum (const ViewFrustum &view_frustum)=default`
- `ViewFrustum (ViewFrustum &&view_frustum)=default`
- `~ViewFrustum ()=default`
- `ViewFrustum & operator= (const ViewFrustum &view_frustum)=default`
- `ViewFrustum & operator= (ViewFrustum &&view_frustum)=default`
- `bool Encloses (const Point3 &point) const`

Private Attributes

- XMFLOAT4 `m_planes` [6]

5.133.1 Constructor & Destructor Documentation

5.133.1.1 `ViewFrustum()` [1/3]

```
mage::ViewFrustum::ViewFrustum (
    const Camera & camera ) [explicit]
```

5.133.1.2 `ViewFrustum()` [2/3]

```
mage::ViewFrustum::ViewFrustum (
    const ViewFrustum & view_frustum ) [default]
```

5.133.1.3 `ViewFrustum()` [3/3]

```
mage::ViewFrustum::ViewFrustum (
    ViewFrustum && view_frustum ) [default]
```

5.133.1.4 `~ViewFrustum()`

```
mage::ViewFrustum::~ViewFrustum ( ) [default]
```

5.133.2 Member Function Documentation

5.133.2.1 `Encloses()`

```
bool mage::ViewFrustum::Encloses (
    const Point3 & point ) const
```

5.133.2.2 `operator=()` [1/2]

```
ViewFrustum& mage::ViewFrustum::operator= (
    const ViewFrustum & view_frustum ) [default]
```

5.133.2.3 `operator=()` [2/2]

```
ViewFrustum& mage::ViewFrustum::operator= (
    ViewFrustum && view_frustum ) [default]
```

5.133.3 Member Data Documentation

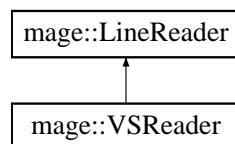
5.133.3.1 m_planes

```
XMFLOAT4 mage::ViewFrustum::m_planes[6] [private]
```

5.134 mage::VSReader Class Reference

```
#include <vs_reader.hpp>
```

Inheritance diagram for mage::VSReader:



Public Member Functions

- `VSReader (vector< Variable > &variable_buffer)`
- `VSReader (const VSReader &reader)=delete`
- `VSReader (VSReader &&reader)`
- `virtual ~VSReader ()`
- `VSReader & operator= (const VSReader &reader)=delete`
- `VSReader & operator= (VSReader &&reader)=delete`

Private Member Functions

- `virtual void ReadLine (char *line) override`
- `void ReadVBool ()`
- `void ReadVInt ()`
- `void ReadVInt2 ()`
- `void ReadVInt3 ()`
- `void ReadVFloat ()`
- `void ReadVFloat2 ()`
- `void ReadVFloat3 ()`
- `void ReadVFloat4 ()`
- `void ReadVColor ()`
- `void ReadVString ()`

Private Attributes

- `vector< Variable > & m_variable_buffer`

Additional Inherited Members

5.134.1 Detailed Description

A class of VS file readers for reading variable scripts.

5.134.2 Constructor & Destructor Documentation

5.134.2.1 VSReader() [1/3]

```
mage::VSReader::VSReader (
    vector< Variable > & variable_buffer ) [explicit]
```

Constructs a VS reader.

Parameters

| | | |
|----|-----------------|---|
| in | variable_buffer | A reference to a vector for storing the read variables from file. |
|----|-----------------|---|

5.134.2.2 VSReader() [2/3]

```
mage::VSReader::VSReader (
    const VSReader & reader ) [delete]
```

Constructs a VS reader from the given VS reader.

Parameters

| | | |
|----|--------|---------------------------------------|
| in | reader | A reference to the VS reader to copy. |
|----|--------|---------------------------------------|

5.134.2.3 VSReader() [3/3]

```
mage::VSReader::VSReader (
    VSReader && reader ) [default]
```

Constructs a VS reader by moving the given VS reader.

Parameters

| | | |
|----|--------|---------------------------------------|
| in | reader | A reference to the VS reader to move. |
|----|--------|---------------------------------------|

5.134.2.4 ~VSReader()

```
mage::VSReader::~VSReader () [virtual], [default]
```

Destructs this VS reader.

5.134.3 Member Function Documentation

5.134.3.1 operator=() [1/2]

```
VSReader& mage::VSReader::operator= (
    const VSReader & reader ) [delete]
```

Copies the given VS reader to this VS reader.

Parameters

| | | |
|----|--------|-------------------------------------|
| in | reader | A reference to a VS reader to copy. |
|----|--------|-------------------------------------|

Returns

A reference to the copy of the given VS reader (i.e. this VS reader).

5.134.3.2 operator=() [2/2]

```
VSReader& mage::VSReader::operator= (
    VSReader && reader ) [delete]
```

Moves the given VS reader to this VS reader.

Parameters

| | | |
|----|--------|-------------------------------------|
| in | reader | A reference to a VS reader to move. |
|----|--------|-------------------------------------|

Returns

A reference to the moved VS reader (i.e. this VS reader).

5.134.3.3 ReadLine()

```
void mage::VSReader::ReadLine (
    char * line ) [override], [private], [virtual]
```

Reads the given line.

Precondition

line is not equal to `nullptr`.

Parameters

| | | |
|---------|------|---|
| in, out | line | A pointer to the null-terminated byte string to read. |
|---------|------|---|

Exceptions

| | |
|---------------------------|--------------------------------|
| <i>FormattedException</i> | Failed to read the given line. |
|---------------------------|--------------------------------|

Implements [mage::LineReader](#).

5.134.3.4 ReadVSBool()

```
void mage::VSReader::ReadVSBool ( ) [private]
```

Reads a Bool variable definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Bool variable definition. |
|---------------------------|--|

5.134.3.5 ReadVSColor()

```
void mage::VSReader::ReadVSColor ( ) [private]
```

Reads a [Color](#) variable definition.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a Color variable definition. |
|---------------------------|---|

5.134.3.6 ReadVSFloat()

```
void mage::VSReader::ReadVSFloat ( ) [private]
```

Reads a Float variable definition.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a Float variable definition. |
|---------------------------|---|

5.134.3.7 ReadVSFloat2()

```
void mage::VSReader::ReadVSFloat2 ( ) [private]
```

Reads a Float2 variable definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Float2 variable definition. |
|---------------------------|--|

5.134.3.8 ReadVSFloat3()

```
void mage::VSReader::ReadVSFloat3 ( ) [private]
```

Reads a Float3 variable definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Float3 variable definition. |
|---------------------------|--|

5.134.3.9 ReadVSFloat4()

```
void mage::VSReader::ReadVSFloat4 ( ) [private]
```

Reads a Float4 variable definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Float4 variable definition. |
|---------------------------|--|

5.134.3.10 ReadVSInt()

```
void mage::VSReader::ReadVSInt ( ) [private]
```

Reads an Int variable definition.

Exceptions

| | |
|---------------------------|---|
| <i>FormattedException</i> | Failed to read a Int variable definition. |
|---------------------------|---|

5.134.3.11 ReadVSInt2()

```
void mage::VSReader::ReadVSInt2 ( ) [private]
```

Reads an Int2 variable definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Int2 variable definition. |
|---------------------------|--|

5.134.3.12 ReadVSInt3()

```
void mage::VSReader::ReadVSInt3 ( ) [private]
```

Reads an Int3 variable definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a Int3 variable definition. |
|---------------------------|--|

5.134.3.13 ReadVSString()

```
void mage::VSReader::ReadVSString ( ) [private]
```

Reads a String variable definition.

Exceptions

| | |
|---------------------------|--|
| <i>FormattedException</i> | Failed to read a String variable definition. |
|---------------------------|--|

5.134.4 Member Data Documentation**5.134.4.1 m_variable_buffer**

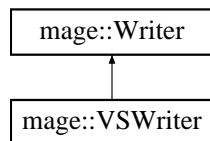
```
vector< Variable >& mage::VSReader::m_variable_buffer [private]
```

A reference to a vector containing the read variables of this VS reader.

5.135 mage::VSWriter Class Reference

```
#include <vs_writer.hpp>
```

Inheritance diagram for mage::VSWriter:

**Public Member Functions**

- **VSWriter** (const vector< Variable > &variable_buffer)
- **VSWriter** (const **VSWriter** &writer)=delete
- **VSWriter** (**VSWriter** &&writer)
- virtual ~**VSWriter** ()
- **VSWriter** & **operator=** (const **VSWriter** &writer)=delete
- **VSWriter** & **operator=** (**VSWriter** &&writer)=delete

Private Member Functions

- virtual void **Write** () override

Private Attributes

- const vector< Variable > & m_variable_buffer

Additional Inherited Members

5.135.1 Detailed Description

A class of VS file writers for writing variable scripts.

5.135.2 Constructor & Destructor Documentation

5.135.2.1 VSWriter() [1/3]

```
mage::VSWriter::VSWriter (
    const vector< Variable > & variable_buffer ) [explicit]
```

Constructs a writer.

Parameters

| | | |
|----|-----------------|--|
| in | variable_buffer | A reference to a vector containing the variables to write to file. |
|----|-----------------|--|

5.135.2.2 VSWriter() [2/3]

```
mage::VSWriter::VSWriter (
    const VSWriter & writer ) [delete]
```

Constructs a VS writer from the given VS writer.

Parameters

| | | |
|----|--------|---------------------------------------|
| in | writer | A reference to the VS writer to copy. |
|----|--------|---------------------------------------|

5.135.2.3 VSWriter() [3/3]

```
mage::VSWriter::VSWriter (
    VSWriter && writer ) [default]
```

Constructs a VS writer by moving the given VS writer.

Parameters

| | | |
|----|--------|---------------------------------------|
| in | writer | A reference to the VS writer to move. |
|----|--------|---------------------------------------|

5.135.2.4 ~VSWriter()

```
mage::VSWriter::~VSWriter () [virtual], [default]
```

Destructs this VS writer.

5.135.3 Member Function Documentation

5.135.3.1 operator=() [1/2]

```
VSWriter& mage::VSWriter::operator= (
    const VSWriter & writer ) [delete]
```

Copies the given VS writer to this VS writer.

Parameters

| | | |
|----|--------|-------------------------------------|
| in | writer | A reference to a VS writer to copy. |
|----|--------|-------------------------------------|

Returns

A reference to the copy of the given VS writer (i.e. this VS writer).

5.135.3.2 operator=() [2/2]

```
VSWriter& mage::VSWriter::operator= (
    VSWriter && writer ) [delete]
```

Moves the given VS writer to this VS writer.

Parameters

| | | |
|----|--------|-------------------------------------|
| in | writer | A reference to a VS writer to move. |
|----|--------|-------------------------------------|

Returns

A reference to the moved VS writer (i.e. this VS writer).

5.135.3.3 Write()

```
void mage::VSWriter::Write () [override], [private], [virtual]
```

Starts writing.

Exceptions

| | |
|--------------------|------------------|
| FormattedException | Failed to write. |
|--------------------|------------------|

Implements [mage::Writer](#).

5.135.4 Member Data Documentation

5.135.4.1 m_variable_buffer

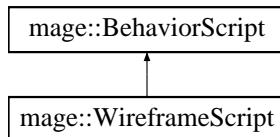
```
const vector< Variable >& mage::VSWriter::m_variable_buffer [private]
```

A reference to a vector containing the variables to write by this VS writer.

5.136 mage::WireframeScript Class Reference

```
#include <wireframe_script.hpp>
```

Inheritance diagram for mage::WireframeScript:



Public Types

- enum [WireframeMode](#) { [WireframeMode_None](#) = 0, [WireframeMode_3D](#) = 1, [WireframeMode_2D](#) = 2, [WireframeMode_3Dand2D](#) = [WireframeMode_3D](#) | [WireframeMode_2D](#) }

Public Member Functions

- [WireframeScript \(\)](#)
- [WireframeScript \(const \[WireframeScript\]\(#\) &script\)=delete](#)
- [WireframeScript \(\[WireframeScript\]\(#\) &&script\)](#)
- [virtual ~WireframeScript \(\)](#)
- [WireframeScript & operator= \(const \[WireframeScript\]\(#\) &script\)=delete](#)
- [WireframeScript & operator= \(\[WireframeScript\]\(#\) &&script\)=delete](#)
- [WireframeMode GetWireframeMode \(\) const](#)
- [void SetWireframeMode \(\[WireframeMode\]\(#\) mode\)](#)
- [virtual void Update \(double delta_time\) override](#)

Private Attributes

- [WireframeMode m_mode](#)
- [bool m_solid](#)

Additional Inherited Members

5.136.1 Member Enumeration Documentation

5.136.1.1 WireframeMode

```
enum mage::WireframeScript::WireframeMode
```

Enumerator

| | |
|-----------------------|--|
| WireframeMode_None | |
| WireframeMode_3D | |
| WireframeMode_2D | |
| WireframeMode_3Dand2D | |

5.136.2 Constructor & Destructor Documentation**5.136.2.1 WireframeScript() [1/3]**

```
mage::WireframeScript::WireframeScript ( )
```

5.136.2.2 WireframeScript() [2/3]

```
mage::WireframeScript::WireframeScript (
    const WireframeScript & script ) [delete]
```

5.136.2.3 WireframeScript() [3/3]

```
mage::WireframeScript::WireframeScript (
    WireframeScript && script ) [default]
```

5.136.2.4 ~WireframeScript()

```
mage::WireframeScript::~WireframeScript ( ) [virtual], [default]
```

5.136.3 Member Function Documentation**5.136.3.1 GetWireframeMode()**

```
WireframeMode mage::WireframeScript::GetWireframeMode ( ) const
```

5.136.3.2 operator=() [1/2]

```
WireframeScript& mage::WireframeScript::operator= (
    const WireframeScript & script ) [delete]
```

5.136.3.3 operator=() [2/2]

```
WireframeScript& mage::WireframeScript::operator= (
    WireframeScript && script ) [delete]
```

5.136.3.4 SetWireframeMode()

```
void mage::WireframeScript::SetWireframeMode (
    WireframeMode mode )
```

5.136.3.5 Update()

```
void mage::WireframeScript::Update (
    double delta_time ) [override], [virtual]
```

Updates this behavior script.

Parameters

| | | |
|----|-------------------|---|
| in | <i>delta_time</i> | The elapsed time since the previous update. |
|----|-------------------|---|

Implements [mage::BehaviorScript](#).

5.136.4 Member Data Documentation

5.136.4.1 m_mode

```
WireframeMode mage::WireframeScript::m_mode [private]
```

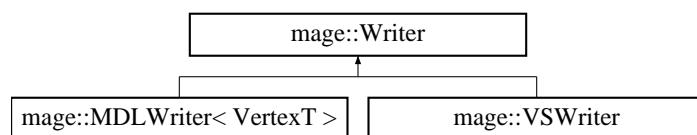
5.136.4.2 m_solid

```
bool mage::WireframeScript::m_solid [private]
```

5.137 mage::Writer Class Reference

```
#include <writer.hpp>
```

Inheritance diagram for mage::Writer:



Public Member Functions

- virtual ~Writer ()
- Writer & operator= (const Writer &writer)=delete
- Writer & operator= (Writer &&writer)=delete
- void WriteToFile (const wstring &fname)
- const wstring & GetFilename () const

Protected Member Functions

- [Writer \(\)](#)
- [Writer \(const Writer &writer\)=delete](#)
- [Writer \(Writer &&writer\)](#)
- [void WriteCharacter \(char c\)](#)
- [void WriteString \(const char *str\)](#)
- [void WriteString \(const string &str\)](#)
- [void WriteStringLine \(const char *str\)](#)
- [void WriteStringLine \(const string &str\)](#)

Private Member Functions

- [virtual void Write \(\)=0](#)

Private Attributes

- [UniqueFileStream m_file_stream](#)
- [wstring m_fname](#)

5.137.1 Detailed Description

A class of writers for writing (non-binary) text files.

5.137.2 Constructor & Destructor Documentation

5.137.2.1 ~Writer()

```
mage::Writer::~Writer ( ) [virtual], [default]
```

Destructs this writer.

5.137.2.2 Writer() [1/3]

```
mage::Writer::Writer ( ) [protected]
```

Constructs a writer.

5.137.2.3 Writer() [2/3]

```
mage::Writer::Writer ( const Writer & writer ) [protected], [delete]
```

Constructs a writer from the given writer.

Parameters

| | | |
|----|---------------------|------------------------------------|
| in | <code>writer</code> | A reference to the writer to copy. |
|----|---------------------|------------------------------------|

5.137.2.4 Writer() [3/3]

```
mage::Writer::Writer (
    Writer && writer )  [protected], [default]
```

Constructs a writer by moving the given writer.

Parameters

| | | |
|----|---------------------|------------------------------------|
| in | <code>writer</code> | A reference to the writer to move. |
|----|---------------------|------------------------------------|

5.137.3 Member Function Documentation**5.137.3.1 GetFilename()**

```
const wstring& mage::Writer::GetFilename ( ) const
```

Returns the current filename of this writer.

Returns

A reference to the current filename of this writer.

5.137.3.2 operator=() [1/2]

```
Writer& mage::Writer::operator= (
    const Writer & writer )  [delete]
```

Copies the given writer to this writer.

Parameters

| | | |
|----|---------------------|----------------------------------|
| in | <code>writer</code> | A reference to a writer to copy. |
|----|---------------------|----------------------------------|

Returns

A reference to the copy of the given writer (i.e. this writer).

5.137.3.3 operator=() [2/2]

```
Writer& mage::Writer::operator= (
    Writer && writer )  [delete]
```

Moves the given writer to this writer.

Parameters

| | | |
|----|---------------|----------------------------------|
| in | <i>writer</i> | A reference to a writer to move. |
|----|---------------|----------------------------------|

Returns

A reference to the moved writer (i.e. this writer).

5.137.3.4 Write()

```
virtual void mage::Writer::Write ( ) [private], [pure virtual]
```

Starts writing.

Exceptions

| | |
|---------------------------|------------------|
| <i>FormattedException</i> | Failed to write. |
|---------------------------|------------------|

Implemented in [mage::MDLWriter< VertexT >](#), and [mage::VSWriter](#).

5.137.3.5 WriteCharacter()

```
void mage::Writer::WriteCharacter (
    char c ) [protected]
```

Writes the given character.

Parameters

| | | |
|----|----------|-------------------------|
| in | <i>c</i> | The character to write. |
|----|----------|-------------------------|

Exceptions

| | |
|---------------------------|--------------------------------------|
| <i>FormattedException</i> | Failed to write the given character. |
|---------------------------|--------------------------------------|

5.137.3.6 WriteString() [1/2]

```
void mage::Writer::WriteString (
    const char * str ) [protected]
```

Writes the given string.

Precondition

str is not equal to `nullptr`.

Parameters

| | | |
|----|------------|--|
| in | <i>str</i> | A pointer to the first null-terminated byte string to write. |
|----|------------|--|

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to write the given string. |
|---------------------------|-----------------------------------|

5.137.3.7 WriteString() [2/2]

```
void mage::Writer::WriteString (
    const string & str )  [protected]
```

Writes the given string.

Parameters

| | | |
|----|------------|-------------------------------------|
| in | <i>str</i> | A reference to the string to write. |
|----|------------|-------------------------------------|

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to write the given string. |
|---------------------------|-----------------------------------|

5.137.3.8 WriteStringLine() [1/2]

```
void mage::Writer::WriteStringLine (
    const char * str )  [protected]
```

Writes the given string and ends the current line.

Precondition

str is not equal to nullptr.

Parameters

| | | |
|----|------------|--|
| in | <i>str</i> | A pointer to the first null-terminated byte string to write. |
|----|------------|--|

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to write the given string. |
|---------------------------|-----------------------------------|

5.137.3.9 WriteStringLine() [2/2]

```
void mage::Writer::WriteStringLine (
```

```
const string & str ) [protected]
```

Writes the given string and ends the current line.

Parameters

| | | |
|----|------------|-------------------------------------|
| in | <i>str</i> | A reference to the string to write. |
|----|------------|-------------------------------------|

Exceptions

| | |
|---------------------------|-----------------------------------|
| <i>FormattedException</i> | Failed to write the given string. |
|---------------------------|-----------------------------------|

5.137.3.10 WriteToFile()

```
void mage::Writer::WriteToFile (
    const wstring & fname )
```

Writes to the given file.

Parameters

| | | |
|----|--------------|-------------------------------|
| in | <i>fname</i> | A reference to the file name. |
|----|--------------|-------------------------------|

Exceptions

| | |
|---------------------------|------------------------------------|
| <i>FormattedException</i> | Failed to write to the given file. |
|---------------------------|------------------------------------|

5.137.4 Member Data Documentation

5.137.4.1 m_file_stream

```
UniqueFileStream mage::Writer::m_file_stream [private]
```

A pointer to the file stream of this writer.

5.137.4.2 m_fname

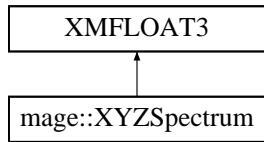
```
wstring mage::Writer::m_fname [private]
```

The current filename of this writer.

5.138 mage::XYZSpectrum Struct Reference

```
#include <spectrum.hpp>
```

Inheritance diagram for mage::XYZSpectrum:



Public Member Functions

- [XYZSpectrum \(\)](#)
- [XYZSpectrum \(float x, float y, float z\)](#)
- [XYZSpectrum \(const XYZSpectrum &xyz\)](#)
- [XYZSpectrum \(XYZSpectrum &&xyz\)](#)
- [XYZSpectrum \(const RGBSpectrum &rgb\)](#)
- [XYZSpectrum \(RGBSpectrum &&rgb\)](#)
- [XYZSpectrum \(const XMFLOAT3 &v\)](#)
- [XYZSpectrum \(XMFLOAT3 &&v\)](#)
- [~XYZSpectrum \(\)=default](#)
- [XYZSpectrum & operator= \(const XYZSpectrum &xyz\)=default](#)
- [XYZSpectrum & operator= \(XYZSpectrum &&xyz\)=default](#)

5.138.1 Detailed Description

A struct of XYZ color spectra.

5.138.2 Constructor & Destructor Documentation

5.138.2.1 XYZSpectrum() [1/8]

```
mage::XYZSpectrum::XYZSpectrum ( )
```

Constructs a XYZ spectrum.

5.138.2.2 XYZSpectrum() [2/8]

```
mage::XYZSpectrum::XYZSpectrum (
    float x,
    float y,
    float z ) [explicit]
```

Constructs a XYZ spectrum from the given spectrum components.

Parameters

| | | |
|----|---|------------------|
| in | x | The x component. |
| in | y | The y component. |
| in | z | The z component. |

5.138.2.3 XYZSpectrum() [3/8]

```
mage::XYZSpectrum::XYZSpectrum (
    const XYZSpectrum & xyz )
```

Constructs a XYZ spectrum from the given XYZ spectrum.

Parameters

| | | |
|----|-----|--|
| in | xyz | A reference to the XYZ spectrum to copy. |
|----|-----|--|

5.138.2.4 XYZSpectrum() [4/8]

```
mage::XYZSpectrum::XYZSpectrum (
    XYZSpectrum && xyz )
```

Constructs a XYZ spectrum by moving the given XYZ spectrum.

Parameters

| | | |
|----|-----|--|
| in | xyz | A reference to the XYZ spectrum to move. |
|----|-----|--|

5.138.2.5 XYZSpectrum() [5/8]

```
mage::XYZSpectrum::XYZSpectrum (
    const RGBSpectrum & rgb ) [explicit]
```

Constructs a XYZ spectrum from the given RGB spectrum.

Parameters

| | | |
|----|-----|--|
| in | rgb | A reference to the RGB spectrum to copy. |
|----|-----|--|

5.138.2.6 XYZSpectrum() [6/8]

```
mage::XYZSpectrum::XYZSpectrum (
    RGBSpectrum && rgb ) [explicit]
```

Constructs a XYZ spectrum by moving the given RGB spectrum.

Parameters

| | | |
|----|------------|--|
| in | <i>rgb</i> | A reference to the RGB spectrum to move. |
|----|------------|--|

5.138.2.7 XYZSpectrum() [7/8]

```
mage::XYZSpectrum::XYZSpectrum (
    const XMFLOAT3 & v ) [explicit]
```

Constructs a XYZ spectrum from the given components.

Parameters

| | | |
|----|----------|--|
| in | <i>v</i> | A reference to the components to copy. |
|----|----------|--|

5.138.2.8 XYZSpectrum() [8/8]

```
mage::XYZSpectrum::XYZSpectrum (
    XMFLOAT3 && v ) [explicit]
```

Constructs a XYZ spectrum by moving the given components.

Parameters

| | | |
|----|----------|--|
| in | <i>v</i> | A reference to the components to move. |
|----|----------|--|

5.138.2.9 ~XYZSpectrum()

```
mage::XYZSpectrum::~XYZSpectrum ( ) [default]
```

Destructs this XYZ spectrum.

5.138.3 Member Function Documentation**5.138.3.1 operator=()** [1/2]

```
XYZSpectrum& mage::XYZSpectrum::operator= (
    const XYZSpectrum & xyz ) [default]
```

Copies the given XYZ spectrum to this XYZ spectrum.

Parameters

| | | |
|----|------------|--|
| in | <i>xyz</i> | A reference to the XYZ spectrum to copy. |
|----|------------|--|

Returns

A reference to the copy of the given XYZ spectrum (i.e. this XYZ spectrum).

5.138.3.2 operator=() [2/2]

```
XYZSpectrum& mage::XYZSpectrum::operator= (
    XYZSpectrum && xyz ) [default]
```

Moves the given XYZ spectrum to this XYZ spectrum.

Parameters

| | | |
|----|-----|--|
| in | xyz | A reference to the XYZ spectrum to move. |
|----|-----|--|

Returns

A reference to the moved XYZ spectrum (i.e. this XYZ spectrum).

