Easy OpenGL

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Directory Documentation

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Chapter 7

Namespace Documentation

7.1 egl Namespace Reference

Data Structures

- class Buffer
- class ProgramLinkError

  Exception thrown when Program linking fails.
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  Exception thrown when Program validation fails, mainly used in debug builds.
- class Program

  Program class to abstract OpenGL Shader Programs.
- class ShaderCompileError

  Exception thrown when Shader compilation fails.
- class Shader

  Shader class to abstract OpenGL Shaders.
- class VertexBuffer

Enumerations

- enum class BufferType {
  Array , AtomicCounter , CopyRead , CopyWrite ,
  DispatchIndirect , DrawIndirect , ElementArray , PixelPack ,
  PixelUnpack , Query , ShaderStorage , Texture ,
  TransformFeedback , Uniform }

  Enum to indicate the type of Buffer.
- enum class BufferUsage {
  StreamDraw , StreamRead , StreamCopy , StaticDraw ,
  StaticRead , StaticCopy , DynamicDraw , DynamicRead ,
  DynamicCopy }

  Enum to indicate Buffer Usage.
- enum class MapUsage : uint32_t {
  None = 0 , Read = 1 << 0 , Write = 1 << 1 , Persistent = 1 << 2 ,
  Coherent = 1 << 3 , InvalidRange = 1 << 4 , InvalidateBuffer = 1 << 5 , FlushExplicit = 1 << 6 ,
  Unsynchronized = 1 << 7 }

  Enum flags to indicate Buffer map usage.

- enum class BufferFlag : uint32_t {
  None = 0 , DynamicStorage = 1 << 0 , MapRead = 1 << 1 , MapWrite = 1 << 2 ,
  MapPersistent = 1 << 3 , MapCoherent = 1 << 4 , ClientStorage = 1 << 5 }

  Enum falgs for explicit Buffer usage in setStorage.
- enum class ShaderType {
  Fragment , Vertex , Geometry , TessEvaluation ,
  TessControl , Compute }

  ShaderType enum to indicate usage.

Functions

- MapUsage operator| (MapUsage a, MapUsage b)
- MapUsage operator& (MapUsage a, MapUsage b)
- MapUsage & operator|= (MapUsage &a, MapUsage b)
- BufferFlag operator| (BufferFlag a, BufferFlag b)
- BufferFlag operator& (BufferFlag a, BufferFlag b)
- BufferFlag & operator|= (BufferFlag &a, BufferFlag b)
- unsigned int toGLenum (BufferType type)
- unsigned int toGLenum (BufferUsage usage)
- unsigned int toGLenum (MapUsage usage)
- unsigned int toGLenum (BufferFlag flag)
- bool validateMapUsage (MapUsage usage, std::string &error)
- bool validateBufferFlag (BufferFlag flag, std::string &error)
- const char * glErrorString (unsigned int err)

  Gets a c-style string from from a OpenGL enum.
- void glCheckError (const char *func, const char *file, int line)

  Checks and prints if any OpenGL error has occured.
- constexpr std::string shaderTypeToString (ShaderType type)

  Converts the ShaderType enum into a std::string.
- unsigned int toGLenum (ShaderType type)

  Converts the ShaderType enum into an OpenGL enum.

7.1.1 Enumeration Type Documentation

7.1.1.1 BufferFlag

```
enum class egl::BufferFlag :  uint32_t  [strong]
```

Enum falgs for explicit Buffer usage in setStorage.

Enumerator

None	
DynamicStorage	Indicates that the contents of the data store may be updated after creation through calls to glBufferSubData.
MapRead	Indicates that the data store may be mapped by the client for read access and a pointer in the client's address space obtained that may be read from.
MapWrite	Indicates that the data store may be mapped by the client for write access and a pointer in the client's address space obtained that may be written through.

MapPersistent	Indicates that the client may request that the server read from or write to the buffer while it is mapped. The client's pointer to the data store remains valid so long as the data store is mapped, even during execution of drawing or dispatch commands.
MapCoherent	Indicates thar shared access to buffers that are simultaneously mapped for client access and are used by the server will be coherent, so long as that mapping is performed using glMapBufferRange.
ClientStorage	When all other criteria for the buffer storage allocation are met, this bit may be used by an implementation to determine whether to use storage that is local to the server or to the client to serve as the backing store for the buffer.

7.1.1.2 BufferType

```
enum class egl::BufferType  [strong]
```

Enum to indicate the type of Buffer.

Enumerator

Array	Vertex attributes.
AtomicCounter	Atomic counter storage.
CopyRead	Buffer copy source.
CopyWrite	Buffer copy destination.
DispatchIndirect	Indirect compute dispatch commands.
DrawIndirect	Indirect command arguments.
ElementArray	Vertex array indices.
PixelPack	Pixel read target.
PixelUnpack	Texture data source.
Query	Query result buffer.
ShaderStorage	Read-write storage for shaders.
Texture	Texture data buffer.
TransformFeedback	Transform feedback buffer.
Uniform	Uniform block storage.

7.1.1.3 BufferUsage

```
enum class egl::BufferUsage  [strong]
```

Enum to indicate Buffer Usage.

The Usage of a buffer can be split into two parts as follows:

The frequency of usage may be one of these:

Stream

- The data store contents will be modified once and used at most a few times.

Static

- The data store contents will be modified once and used many times.

Dynamic

- The data store contents will be modified repeatedly and used many times.

The nature of usage may be one of these:

Draw

- The data store contents are modified by the application, and used as the source for GL drawing and image specification commands.

Read

- The data store contents are modified by reading data from the GL, and used to return that data when queried by the application.

Copy

- The data store contents are modified by reading data from the GL, and used as the source for GL drawing and image specification commands.

Enumerator

StreamDraw	
StreamRead	
StreamCopy	
StaticDraw	
StaticRead	
StaticCopy	
DynamicDraw	
DynamicRead	
DynamicCopy	

7.1.1.4 MapUsage

```
enum class egl::MapUsage : uint32_t [strong]
```

Enum flags to indicate Buffer map usage.

Enumerator

None	
Read	Indicates that the returned pointer may be used to read buffer object data.
Write	Indicates that the returned pointer may be used to modify buffer object data.
Persistent	Indicates that the mapping is to be made in a persistent fassion and that the client intends to hold and use the returned pointer during subsequent GL operation.
Coherent	Indicates that a persistent mapping is also to be coherent. Coherent maps guarantee that the effect of writes to a buffer's data store by either the client or server will eventually become visible to the other without further intervention from the application.
InvalidRange	Indicates that the previous contents of the specified range may be discarded. Data within this range are undefined with the exception of subsequently written data.
InvalidateBuffer	Indicates that the previous contents of the entire buffer may be discarded. Data within the entire buffer are undefined with the exception of subsequently written data.
FlushExplicit	Indicates that one or more discrete subranges of the mapping may be modified. When this flag is set, modifications to each subrange must be explicitly flushed by calling glFlush↩ MappedBufferRange.
Unsynchronized	Indicates that the GL should not attempt to synchronize pending operations on the buffer prior to returning from glMapBufferRange or glMapNamedBufferRange.

7.1.1.5 ShaderType

```
enum class egl::ShaderType [strong]
```

ShaderType enum to indicate usage.

Enumerator

Fragment	A Shader that is intended to run on the programmable fragment processor.
Vertex	A Shader that is intended to run on the programmable vertex processor.
Geometry	A Shader that is intended to run on the programmable geometry processor.
TessEvaluation	A Shader that is intended to run on the programmable tessellation processor in the evaluation stage.
TessControl	A Shader that is intended to run on the programmable tessellation processor in the control stage.
Compute	A Shader intended to run on the programmable compute processor.

7.1.2 Function Documentation

7.1.2.1 glCheckError()

```
void egl::glCheckError (
            const char * func,
```

```
            const char * file,
            int line)
```

Checks and prints if any OpenGL error has occured.

Iterates over the OpenGL error flags with glGetError and prints them until no error are found anymore.

Note

Mainly used in the GL_CALL macro in the backend of the Easy OpenGL abstraction.

Parameters

func	The line of code that is being checked as a c-style string for debug output
file	The file in which this function was called as a c-style string for debug output
line	The line on which this function was called for debug output

7.1.2.2 glErrorString()

```
const char * egl::glErrorString (
            unsigned int err)
```

Gets a c-style string from from a OpenGL enum.

Note

Returns "UNKNOWN_ERROR" if the error is not known.

Mainly used in the GL_CALL macro in the backend of the Easy OpenGL abstraction.

Parameters

err	OpenGL error enum to get the string of

Returns

c-style NULL terminated string

7.1.2.3 operator&() [1/2]

```
BufferFlag egl::operator& (
            BufferFlag a,
            BufferFlag b)  [inline]
```

7.1.2.4 operator&() [2/2]

```
MapUsage egl::operator& (
            MapUsage a,
            MapUsage b)  [inline]
```

7.1.2.5 operator"|() [1/2]

```
BufferFlag egl::operator| (
            BufferFlag a,
            BufferFlag b)  [inline]
```

7.1.2.6 operator"|() [2/2]

```
MapUsage egl::operator| (
            MapUsage a,
            MapUsage b)  [inline]
```

7.1.2.7 operator"|=() [1/2]

```
BufferFlag & egl::operator|= (
            BufferFlag & a,
            BufferFlag b)  [inline]
```

7.1.2.8 operator"|=() [2/2]

```
MapUsage & egl::operator|= (
            MapUsage & a,
            MapUsage b)  [inline]
```

7.1.2.9 shaderTypeToString()

```
std::string egl::shaderTypeToString (
            ShaderType type)  [constexpr]
```

Converts the ShaderType enum into a std::string.

Parameters

type	The ShaderType to convert to a std::string.

Returns

The name of the given ShaderType (if unknown "INVALID" is returned).

7.1.2.10 toGLenum() [1/5]

```
unsigned int egl::toGLenum (
            BufferFlag flag)
```

7.1.2.11 toGLenum() [2/5]

```
unsigned int egl::toGLenum (
            BufferType type)
```

7.1.2.12 toGLenum() [3/5]

```
unsigned int egl::toGLenum (
            BufferUsage usage)
```

7.1.2.13 toGLenum() [4/5]

```
unsigned int egl::toGLenum (
            MapUsage usage)
```

7.1.2.14 toGLenum() [5/5]

```
unsigned int egl::toGLenum (
            ShaderType type)
```

Converts the ShaderType enum into an OpenGL enum.

Exceptions

std::logic_error	If the ShaderType is invalid.

Parameters

type	The ShaderType to convert to a std::string.

Returns

The resulting OpenGL enum.

7.1.2.15 validateBufferFlag()

```
bool egl::validateBufferFlag (
            BufferFlag flag,
            std::string & error)
```

7.1.2.16 validateMapUsage()

```
bool egl::validateMapUsage (
            MapUsage usage,
            std::string & error)
```

Chapter 8

Data Structure Documentation

8.1 egl::Buffer Class Reference

`#include <buffer.h>`

Public Member Functions

- Buffer ()=delete
- Buffer (BufferType type)
- Buffer (Buffer &&other)
- Buffer (const Buffer &other)=delete
- ~Buffer () noexcept
- void bind () const
- int64_t size () const
- BufferType getType () const
- void setData (int64_t size, const void *data, BufferUsage usage)
- void setStorage (int64_t size, const void *data, BufferFlag flags)
- void setSubData (int64_t offset, int64_t size, const void *data)
- void getSubData (int64_t offset, int64_t size, void *data)
- void * map (int64_t offset, int64_t length, MapUsage access)
- void unmap ()
- Buffer & operator= (Buffer &&other)
- Buffer & operator= (const Buffer &other)=delete

Protected Member Functions

- void _delete ()
- void _check ()

Protected Attributes

- unsigned int _id = 0
- bool _mapped = false
- MapUsage _mapUsage = MapUsage::None
- BufferFlag _flags = BufferFlag::None
- BufferType _type

8.1.1 Constructor & Destructor Documentation

8.1.1.1 Buffer() [1/4]

```
egl::Buffer::Buffer ()  [delete]
```

8.1.1.2 Buffer() [2/4]

```
egl::Buffer::Buffer (
            BufferType type)
```

8.1.1.3 Buffer() [3/4]

```
egl::Buffer::Buffer (
            Buffer && other)
```

8.1.1.4 Buffer() [4/4]

```
egl::Buffer::Buffer (
            const Buffer & other)  [delete]
```

8.1.1.5 ~Buffer()

```
egl::Buffer::~Buffer ()  [noexcept]
```

8.1.2 Member Function Documentation

8.1.2.1 _check()

```
void egl::Buffer::_check ()  [protected]
```

8.1.2.2 _delete()

```
void egl::Buffer::_delete ()  [protected]
```

8.1.2.3 bind()

```
void egl::Buffer::bind () const
```

8.1.2.4 getSubData()

```
void egl::Buffer::getSubData (
            int64_t offset,
            int64_t size,
            void * data)
```

8.1.2.5 getType()

```
BufferType egl::Buffer::getType () const
```

8.1.2.6 map()

```
void * egl::Buffer::map (
            int64_t offset,
            int64_t length,
            MapUsage access)
```

8.1.2.7 operator=() [1/2]

```
Buffer & egl::Buffer::operator= (
            Buffer && other)
```

8.1.2.8 operator=() [2/2]

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

8.1.2.9 setData()

```
void egl::Buffer::setData (
            int64_t size,
            const void * data,
            BufferUsage usage)
```

8.1.2.10 setStorage()

```
void egl::Buffer::setStorage (
            int64_t size,
            const void * data,
            BufferFlag flags)
```

8.1.2.11 setSubData()

```
void egl::Buffer::setSubData (
            int64_t offset,
            int64_t size,
            const void * data)
```

8.1.2.12 size()

```
int64_t egl::Buffer::size () const
```

8.1.2.13 unmap()

```
void egl::Buffer::unmap ()
```

8.1.3 Field Documentation

8.1.3.1 _flags

```
BufferFlag egl::Buffer::_flags = BufferFlag::None  [protected]
```

8.1.3.2 _id

```
unsigned int egl::Buffer::_id = 0  [protected]
```

8.1.3.3 _mapped

```
bool egl::Buffer::_mapped = false  [protected]
```

8.1.3.4 _mapUsage

```
MapUsage egl::Buffer::_mapUsage = MapUsage::None  [protected]
```

8.1.3.5 _type

```
BufferType egl::Buffer::_type  [protected]
```

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

- inc/EGL/buffer.h

8.2 egl::Program Class Reference

Program class to abstract OpenGL Shader Programs.

```
#include <program.h>
```

Public Member Functions

- Program ()

  Construct an empty Program object.
- Program (Program &&other)
- Program (const Program &)=delete
- ~Program ()
- void reset ()

  Resets the Program to an empty State.
- bool attached (const Shader &shader)

  Checks if the given Shader is attached to the Program.
- void attach (const Shader &shader)

  Attaches Shader to Program for linking.
- void detach (const Shader &shader)

  Detaches Shader from Program for linking.
- bool linked () const

  Gets if the Program has been successfully linked.
- void link ()

  Links all attached Shaders and creates a valid Program.
- void bind ()

  Binds this Program.
- Program & operator= (Program &&other)
- Program & operator= (const Program &)=delete

Static Public Member Functions

- static void unbind ()

  Unbinds a Program by binding id 0.

Protected Member Functions

- void _delete ()
- void _check ()
- void _ensure ()
- std::string _getError ()

Protected Attributes

- unsigned int _id = 0
- bool _linked = false

8.2.1 Detailed Description

Program class to abstract OpenGL Shader Programs.

Warning

This class is not guaranteed to be thread-safe.

Note

This class owns the underlying OpenGL Program object and releases it upon destruction or reset().

8.2.2 Constructor & Destructor Documentation

8.2.2.1 Program() [1/3]

```
egl::Program::Program ()
```

Construct an empty Program object.

8.2.2.2 Program() [2/3]

```
egl::Program::Program (
            Program && other)
```

8.2.2.3 Program() [3/3]

```
egl::Program::Program (
            const Program & )  [delete]
```

8.2.2.4 ~Program()

```
egl::Program::~Program ()
```

8.2.3 Member Function Documentation

8.2.3.1 _check()

```
void egl::Program::_check ()  [protected]
```

8.2.3.2 _delete()

```
void egl::Program::_delete ()  [protected]
```

8.2.3.3 _ensure()

```
void egl::Program::_ensure ()  [protected]
```

8.2.3.4 _getError()

```
std::string egl::Program::_getError ()  [protected]
```

8.2.3.5 attach()

```
void egl::Program::attach (
            const Shader & shader)
```

Attaches Shader to Program for linking.

Note

Attaching a Shader invalidates the current link state.

Warning

Attaching a destroyed Shader is undefined behavior.

Attached Shaders must outlive the Program (at least until linking).

Exceptions

std::runtime_error	If the Shader has already been attached.
std::logic_error	If the current Program object does not exist (reset() is recommended to return to a valid state).

Parameters

shader	The Shader that should be attached to the Program.

8.2.3.6 attached()

```
bool egl::Program::attached (
            const Shader & shader)
```

Checks if the given Shader is attached to the Program.

Parameters

shader	The Shader to check.

Exceptions

std::logic_error	If the current Program object does not exist (reset() is recommended to return to a valid state).

Returns

true if the Shader is attached, false otherwise.

8.2.3.7 bind()

```
void egl::Program::bind ()
```

Binds this Program.

Exceptions

std::logic_error	If the current Program object does not exist (reset() is recommended to return to a valid state).
std::runtime_error	If the Program was not linked to avoid invalid usage.

8.2.3.8 detach()

```
void egl::Program::detach (
            const Shader & shader)
```

Detaches Shader from Program for linking.

Note

Detaching a Shader invalidates the current link state.

Exceptions

std::runtime_error	If the Shader was not attached.
std::logic_error	If the current Program object does not exist (reset() is recommended to return to a valid state).

Parameters

shader	The Shader that should be detached from the Program.

8.2.3.9 link()

```
void egl::Program::link ()
```

Links all attached Shaders and creates a valid Program.

Exceptions

std::logic_error	If the current Program object does not exist (reset() is recommended to return to a valid state).
egl::ProgramLinkError	If the Program fails to link. The Program remains in a valid state afterwards.
egl::ProgramValidateError	If the Program fails to validate. This only occurs when DEBUG_BUILD is defined else the validity is not checked.

8.2.3.10 linked()

```
bool egl::Program::linked () const  [inline]
```

Gets if the Program has been successfully linked.

Returns

true if the Program is linked, false otherwise.

8.2.3.11 operator=() [1/2]

```
Program & egl::Program::operator= (
            const Program & )  [delete]
```

8.2.3.12 operator=() [2/2]

```
Program & egl::Program::operator= (
            Program && other)
```

8.2.3.13 reset()

```
void egl::Program::reset ()
```

Resets the Program to an empty State.

Exceptions

std::runtime_error	If OpenGL failed to create a new Program.

8.2.3.14 unbind()

```
void egl::Program::unbind ()  [static]
```

Unbinds a Program by binding id 0.

8.2.4 Field Documentation

8.2.4.1 _id

```
unsigned int egl::Program::_id = 0  [protected]
```

8.2.4.2 _linked

```
bool egl::Program::_linked = false  [protected]
```

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

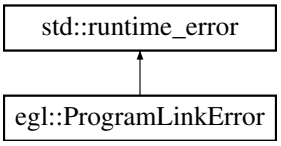
- inc/EGL/program.h

8.3 egl::ProgramLinkError Class Reference

Exception thrown when Program linking fails.

```
#include <program.h>
```

Inheritance diagram for egl::ProgramLinkError:



Public Member Functions

- ProgramLinkError (const std::string &infoLog)
  Construct a new Program Link Error object.

8.3.1 Detailed Description

Exception thrown when Program linking fails.

8.3.2 Constructor & Destructor Documentation

8.3.2.1 ProgramLinkError()

```
egl::ProgramLinkError::ProgramLinkError (
            const std::string & infoLog)  [inline]
```

Construct a new Program Link Error object.

Parameters

infoLog	InfoLog buffer from glGetProgramInfoLog.

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

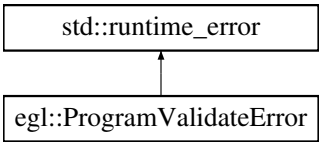
- inc/EGL/program.h

8.4 egl::ProgramValidateError Class Reference

Exception thrown when Program validation fails, mainly used in debug builds.

`#include <program.h>`

Inheritance diagram for egl::ProgramValidateError:



Public Member Functions

- ProgramValidateError (const std::string &infoLog)
  Construct a new Program Validate Error object.

8.4.1 Detailed Description

Exception thrown when Program validation fails, mainly used in debug builds.

8.4.2 Constructor & Destructor Documentation

8.4.2.1 ProgramValidateError()

```
egl::ProgramValidateError::ProgramValidateError (
            const std::string & infoLog)  [inline]
```

Construct a new Program Validate Error object.

Parameters

infoLog	InfoLog buffer from glGetProgramInfoLog.

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

- inc/EGL/program.h

8.5 egl::Shader Class Reference

Shader class to abstract OpenGL Shaders.

`#include <shader.h>`

Public Member Functions

- Shader ()=delete
- Shader (ShaderType type)

  Construct a new Shader object of given type.
- Shader (ShaderType type, const char *src)

  Constructs and compiles a new Shader object of given type.
- Shader (ShaderType type, const std::string &src)

  Constructs and compiles a new Shader object of given type.
- Shader (ShaderType type, std::istream &in)

  Constructs and compiles a new Shader object of given type.
- Shader (Shader &&other)
- Shader (const Shader &other)=delete
- ~Shader () noexcept
- void reset ()

  Resets the Shader to an empty state.
- bool compiled () const

  Gets if the Shader has been successfully compiled.
- ShaderType getType () const

  Get the type of the Shader.
- void compile (const char *src)

  Compiles the Shader with the given source.
- void compile (std::istream &in)

  Compiles the Shader with the given source input stream.
- void compile (const std::string &str)

  Compiles the Shader with the given source.
- Shader & operator= (Shader &&other)
- Shader & operator= (const Shader &other)=delete

Data Fields

- friend Program

Protected Member Functions

- void _delete ()
- void _check ()
- void _ensure ()
- std::string _getError ()

Protected Attributes

- unsigned int _id = 0
- ShaderType _type
- bool _compiled = false

8.5.1 Detailed Description

Shader class to abstract OpenGL Shaders.

Warning

This class is not guaranteed to be thread-safe.

Note

This class owns the underlying OpenGL Shader object and releases it upon destruction or reset().

8.5.2 Constructor & Destructor Documentation

8.5.2.1 Shader() [1/7]

```
egl::Shader::Shader ()  [delete]
```

8.5.2.2 Shader() [2/7]

```
egl::Shader::Shader (
            ShaderType type)
```

Construct a new Shader object of given type.

Exceptions

std::logic_error	If the given ShaderType is invalid.
std::runtime_error	If OpenGL failed to create a Shader object.

8.5.2.3 Shader() [3/7]

```
egl::Shader::Shader (
            ShaderType type,
            const char * src)
```

Constructs and compiles a new Shader object of given type.

Exceptions

std::logic_error	If the given ShaderType is invalid.
std::runtime_error	If OpenGL failed to create a Shader object.
std::invalid_argument	If the Shader source is NULL.
egl::ShaderCompileError	If the Shader fails to compile.

8.5.2.4 Shader() [4/7]

```
egl::Shader::Shader (
            ShaderType type,
            const std::string & src)
```

Constructs and compiles a new Shader object of given type.

Exceptions

std::logic_error	If the given ShaderType is invalid.
std::runtime_error	If OpenGL failed to create a Shader object.
std::invalid_argument	If the Shader source is NULL.
egl::ShaderCompileError	If the Shader fails to compile.

8.5.2.5 Shader() [5/7]

```
egl::Shader::Shader (
            ShaderType type,
            std::istream & in)
```

Constructs and compiles a new Shader object of given type.

Exceptions

std::logic_error	If the given ShaderType is invalid.
std::runtime_error	If OpenGL failed to create a Shader object.
std::invalid_argument	If the given input stream is invalid.
std::invalid_argument	If the Shader source is NULL.
egl::ShaderCompileError	If the Shader fails to compile.

8.5.2.6 Shader() [6/7]

```
egl::Shader::Shader (
            Shader && other)
```

8.5.2.7 Shader() [7/7]

```
egl::Shader::Shader (
            const Shader & other)  [delete]
```

8.5.2.8 ~Shader()

```
egl::Shader::~Shader ()  [noexcept]
```

8.5.3 Member Function Documentation

8.5.3.1 _check()

```
void egl::Shader::_check ()  [protected]
```

8.5.3.2 _delete()

```
void egl::Shader::_delete ()  [protected]
```

8.5.3.3 _ensure()

```
void egl::Shader::_ensure ()  [protected]
```

8.5.3.4 _getError()

```
std::string egl::Shader::_getError ()  [protected]
```

8.5.3.5 compile() [1/3]

```
void egl::Shader::compile (
            const char * src)
```

Compiles the Shader with the given source.

Exceptions

std::invalid_argument	If the Shader source is NULL.
std::logic_error	If the current Shader object does not exist (reset() is recommended to return to a valid state).
egl::ShaderCompileError	If the Shader fails to compile.

Parameters

src	Null terminated c-style string to compile.

8.5.3.6 compile() [2/3]

```
void egl::Shader::compile (
            const std::string & str)
```

Compiles the Shader with the given source.

Exceptions

std::invalid_argument	If the given input stream is invalid.
std::invalid_argument	If the Shader source is NULL.
std::logic_error	If the current Shader object does not exist (reset() is recommended to return to a valid state).
egl::ShaderCompileError	If the Shader fails to compile.

Parameters

src	Source to compile.

8.5.3.7 compile() [3/3]

```
void egl::Shader::compile (
            std::istream & in)
```

Compiles the Shader with the given source input stream.

Note

Reads the entire stream and compiles it.

Exceptions

std::invalid_argument	If the Shader source is NULL.
std::logic_error	If the current Shader object does not exist (reset() is recommended to return to a valid state).
egl::ShaderCompileError	If the Shader fails to compile.

Parameters

in	Input stream to compile.

8.5.3.8 compiled()

```
bool egl::Shader::compiled () const  [inline]
```

Gets if the Shader has been successfully compiled.

8.5.3.9 getType()

```
ShaderType egl::Shader::getType () const  [inline]
```

Get the type of the Shader.

8.5.3.10 operator=() [1/2]

```
Shader & egl::Shader::operator= (
            const Shader & other)  [delete]
```

8.5.3.11 operator=() [2/2]

```
Shader & egl::Shader::operator= (
            Shader && other)
```

8.5.3.12 reset()

```
void egl::Shader::reset ()
```

Resets the Shader to an empty state.

Note

Reset creates an entirely new Shader object of the current type and therefore can be used to get a valid State as long as OpenGL doesn't fail to create a new Shader object.

Exceptions

std::runtime_error	If OpenGL failed to create a new Shader object.

8.5.4 Field Documentation

8.5.4.1 _compiled

```
bool egl::Shader::_compiled = false  [protected]
```

8.5.4.2 _id

```
unsigned int egl::Shader::_id = 0  [protected]
```

8.5.4.3 _type

```
ShaderType egl::Shader::_type  [protected]
```

8.5.4.4 Program

```
friend egl::Shader::Program
```

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

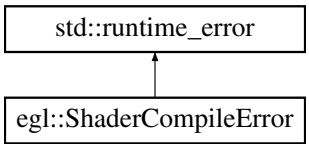
- inc/EGL/shader.h

8.6 egl::ShaderCompileError Class Reference

Exception thrown when Shader compilation fails.

```
#include <shader.h>
```

Inheritance diagram for egl::ShaderCompileError:



Public Member Functions

- ShaderCompileError (ShaderType ShaderType, const std::string &infoLog)
  Construct a new Shader Compile Error object.

8.6.1 Detailed Description

Exception thrown when Shader compilation fails.

8.6.2 Constructor & Destructor Documentation

8.6.2.1 ShaderCompileError()

```
egl::ShaderCompileError::ShaderCompileError (
            ShaderType ShaderType,
            const std::string & infoLog)  [inline]
```

Construct a new Shader Compile Error object.

Parameters

ShaderType	The type of Shader that failed to compile.
infoLog	InfoLog buffer from glGetShaderInfoLog.

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

- inc/EGL/shader.h

8.7 egl::VertexBuffer Class Reference

`#include <vertexBuffer.h>`

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

- inc/EGL/vertexBuffer.h

Chapter 9

File Documentation

9.1 inc/EGL/buffer.h File Reference

```
#include <string>
#include <stdexcept>
#include <cstdint>
```

Data Structures

- class egl::Buffer

Namespaces

- namespace egl

Enumerations

- enum class egl::BufferType {
  egl::Array , egl::AtomicCounter , egl::CopyRead , egl::CopyWrite ,
  egl::DispatchIndirect , egl::DrawIndirect , egl::ElementArray , egl::PixelPack ,
  egl::PixelUnpack , egl::Query , egl::ShaderStorage , egl::Texture ,
  egl::TransformFeedback , egl::Uniform }

  Enum to indicate the type of Buffer.
- enum class egl::BufferUsage {
  egl::StreamDraw , egl::StreamRead , egl::StreamCopy , egl::StaticDraw ,
  egl::StaticRead , egl::StaticCopy , egl::DynamicDraw , egl::DynamicRead ,
  egl::DynamicCopy }

  Enum to indicate Buffer Usage.
- enum class egl::MapUsage : uint32_t {
  egl::None = 0 , egl::Read = 1 << 0 , egl::Write = 1 << 1 , egl::Persistent = 1 << 2 ,
  egl::Coherent = 1 << 3 , egl::InvalidRange = 1 << 4 , egl::InvalidateBuffer = 1 << 5 , egl::FlushExplicit = 1
  << 6 ,
  egl::Unsynchronized = 1 << 7 }

  Enum flags to indicate Buffer map usage.
- enum class egl::BufferFlag : uint32_t {
  egl::None = 0 , egl::DynamicStorage = 1 << 0 , egl::MapRead = 1 << 1 , egl::MapWrite = 1 << 2 ,
  egl::MapPersistent = 1 << 3 , egl::MapCoherent = 1 << 4 , egl::ClientStorage = 1 << 5 }

  Enum falgs for explicit Buffer usage in setStorage.

Functions

- MapUsage egl::operator| (MapUsage a, MapUsage b)
- MapUsage egl::operator& (MapUsage a, MapUsage b)
- MapUsage & egl::operator|= (MapUsage &a, MapUsage b)
- BufferFlag egl::operator| (BufferFlag a, BufferFlag b)
- BufferFlag egl::operator& (BufferFlag a, BufferFlag b)
- BufferFlag & egl::operator|= (BufferFlag &a, BufferFlag b)
- unsigned int egl::toGLenum (BufferType type)
- unsigned int egl::toGLenum (BufferUsage usage)
- unsigned int egl::toGLenum (MapUsage usage)
- unsigned int egl::toGLenum (BufferFlag flag)
- bool egl::validateMapUsage (MapUsage usage, std::string &error)
- bool egl::validateBufferFlag (BufferFlag flag, std::string &error)

9.2 buffer.h

Go to the documentation of this file.

```
00001 #ifndef EGL_BUFFER_H
00002 #define EGL_BUFFER_H
00003
00004 #include <string>
00005 #include <stdexcept>
00006 #include <cstdint>
00007
00008 namespace egl {
00009
00013 enum class BufferType {
00014     Array,
00015     AtomicCounter,
00016     CopyRead,
00017     CopyWrite,
00018     DispatchIndirect,
00019     DrawIndirect,
00020     ElementArray,
00021     PixelPack,
00022     PixelUnpack,
00023     Query,
00024     ShaderStorage,
00025     Texture,
00026     TransformFeedback,
00027     Uniform
00028 };
00029
00058 enum class BufferUsage {
00059     StreamDraw,
00060     StreamRead,
00061     StreamCopy,
00062     StaticDraw,
00063     StaticRead,
00064     StaticCopy,
00065     DynamicDraw,
00066     DynamicRead,
00067     DynamicCopy
00068 };
00069
00073 enum class MapUsage : uint32_t {
00074     None                    = 0,
00075     Read                    = 1 << 0,
00076     Write                   = 1 << 1,
00077     Persistent              = 1 << 2,
00078     Coherent                = 1 << 3,
00079     InvalidRange            = 1 << 4,
00080     InvalidateBuffer        = 1 << 5,
00081     FlushExplicit           = 1 << 6,
00082     Unsynchronized          = 1 << 7
00083 };
00084
00085 inline MapUsage operator|(MapUsage a, MapUsage b) {
00086     return static_cast<MapUsage>(
00087         static_cast<uint32_t>(a) | static_cast<uint32_t>(b)
00088     );
00089 }
```

```
00090
00091 inline MapUsage operator&(MapUsage a, MapUsage b) {
00092     return static_cast<MapUsage>(
00093         static_cast<uint32_t>(a) & static_cast<uint32_t>(b)
00094     );
00095 }
00096
00097 inline MapUsage& operator|=(MapUsage& a, MapUsage b) {
00098     a = a | b;
00099     return a;
00100 }
00101
00105 enum class BufferFlag : uint32_t {
00106     None            = 0,
00107     DynamicStorage  = 1 << 0,
00108     MapRead         = 1 << 1,
00109     MapWrite        = 1 << 2,
00110     MapPersistent   = 1 << 3,
00111     MapCoherent     = 1 << 4,
00112     ClientStorage   = 1 << 5
00113 };
00114
00115 inline BufferFlag operator|(BufferFlag a, BufferFlag b) {
00116     return static_cast<BufferFlag>(
00117         static_cast<uint32_t>(a) | static_cast<uint32_t>(b)
00118     );
00119 }
00120
00121 inline BufferFlag operator&(BufferFlag a, BufferFlag b) {
00122     return static_cast<BufferFlag>(
00123         static_cast<uint32_t>(a) & static_cast<uint32_t>(b)
00124     );
00125 }
00126
00127 inline BufferFlag& operator|=(BufferFlag& a, BufferFlag b) {
00128     a = a | b;
00129     return a;
00130 }
00131
00132 unsigned int toGLenum(BufferType type);
00133 unsigned int toGLenum(BufferUsage usage);
00134 unsigned int toGLenum(MapUsage usage);
00135 unsigned int toGLenum(BufferFlag flag);
00136 bool validateMapUsage(MapUsage usage, std::string& error);
00137 bool validateBufferFlag(BufferFlag flag, std::string& error);
00138
00139 class Buffer {
00140 protected:
00141     unsigned int _id = 0;
00142     bool _mapped = false;
00143     MapUsage _mapUsage = MapUsage::None;
00144     BufferFlag _flags = BufferFlag::None;
00145     BufferType _type;
00146
00147     void _delete();
00148     void _check();
00149
00150 public:
00151     Buffer() = delete;
00152     Buffer(BufferType type);
00153     Buffer(Buffer&& other);
00154     Buffer(const Buffer& other) = delete;
00155     ~Buffer() noexcept;
00156
00157     void bind() const;
00158     int64_t size() const;
00159
00160     BufferType getType() const;
00161
00162     void setData(int64_t size, const void* data, BufferUsage usage); // size in bytes
00163     void setStorage(int64_t size, const void* data, BufferFlag flags); // size in bytes
00164
00165     void setSubData(int64_t offset, int64_t size, const void* data); // offset and size in bytes
00166
00167     void getSubData(int64_t offset, int64_t size, void* data); // data must be at least be as big as
      size
00168
00169     void* map(int64_t offset, int64_t length, MapUsage access); // get a pointer to the buffer data
      for a specific usage
00170     void unmap();
00171
00172     Buffer& operator=(Buffer&& other);
00173     Buffer& operator=(const Buffer& other) = delete;
00174 };
00175
00176 }
00177
```

```
00178 #endif
```

9.3 inc/EGL/debug.h File Reference

Namespaces

- namespace egl

Macros

- #define GL_CALL(x)

  Runs the given code and checks for errors.
- #define DEBUG_ONLY(x)

  Runs given code only if DEBUG_BUILD is defined.

Functions

- const char * egl::glErrorString (unsigned int err)

  Gets a c-style string from from a OpenGL enum.
- void egl::glCheckError (const char *func, const char *file, int line)

  Checks and prints if any OpenGL error has occured.

9.3.1 Macro Definition Documentation

9.3.1.1 DEBUG_ONLY

```
#define DEBUG_ONLY(
                x)
```

Value:

```
((void)0)
```

Runs given code only if DEBUG_BUILD is defined.

9.3.1.2 GL_CALL

```
#define GL_CALL(
                x)
```

Value:

```
x
```

Runs the given code and checks for errors.

Note

For performance reasons egl::glCheckError is only called when DEBUG_BUILD is defined.

Warning

The code is run in a scope below the current.

Parameters

x	The code to run before checking for errors

9.4 debug.h

Go to the documentation of this file.

```
00001 #ifndef EGL_DEBUG_H
00002 #define EGL_DEBUG_H
00003
00004 namespace egl {
00005
00015 const char* glErrorString(unsigned int err);
00016
00028 void glCheckError(const char* func, const char* file, int line);
00029
00030 };
00031
00040
00044
00045 #ifdef DEBUG_BUILD
00046
00047     #define GL_CALL(x) do { x; egl::glCheckError(#x, __FILE__, __LINE__); } while(0)
00048
00049     #define DEBUG_ONLY(x) x
00050
00051 #else
00052
00053     #define GL_CALL(x) x
00054
00055     #define DEBUG_ONLY(x) ((void)0)
00056
00057 #endif
00058
00059 #endif
```

9.5 inc/EGL/program.h File Reference

```
#include <string>
#include <stdexcept>
```

Data Structures

- class egl::ProgramLinkError

  Exception thrown when Program linking fails.
- class egl::ProgramValidateError

  Exception thrown when Program validation fails, mainly used in debug builds.
- class egl::Program

  Program class to abstract OpenGL Shader Programs.

Namespaces

- namespace egl

9.6 program.h

Go to the documentation of this file.

```
00001 #ifndef EGL_PROGRAM_H
00002 #define EGL_PROGRAM_H
00003
00004 #include <string>
00005 #include <stdexcept>
00006
00007 namespace egl {
00008
00009 class Shader;
00010
00014 class ProgramLinkError : public std::runtime_error {
00015 public:
00021     ProgramLinkError(const std::string& infoLog)
00022         : std::runtime_error(
00023               "Program link failed:\n" + infoLog) {}
00024 };
00025
00029 class ProgramValidateError : public std::runtime_error {
00030 public:
00036     ProgramValidateError(const std::string& infoLog)
00037         : std::runtime_error(
00038               "Program validation failed:\n" + infoLog) {}
00039 };
00040
00049 class Program {
00050 protected:
00051     unsigned int _id = 0;
00052     bool _linked = false;
00053
00054     void _delete();
00055     void _check();
00056     void _ensure();
00057     std::string _getError();
00058
00059 public:
00063     Program();
00064     Program(Program&& other);
00065     Program(const Program&) = delete; // OpenGL Programs are not copy safe
00066     ~Program();
00067
00073     void reset();
00074
00084     bool attached(const Shader& shader);
00085
00099     void attach(const Shader& shader);
00100
00111     void detach(const Shader& shader);
00112
00118     bool linked() const { return _linked; }
00119
00127     void link();
00128
00135     void bind();
00136
00140     static void unbind();
00141
00142     Program& operator=(Program&& other);
00143     Program& operator=(const Program&) = delete; // OpenGL Programs are not copy safe
00144 };
00145
00146 }
00147
00148 #endif
```

9.7 inc/EGL/shader.h File Reference

```
#include <string>
#include <stdexcept>
#include <iosfwd>
```

Data Structures

- class egl::ShaderCompileError

  Exception thrown when Shader compilation fails.
- class egl::Shader

  Shader class to abstract OpenGL Shaders.

Namespaces

- namespace egl

Enumerations

- enum class egl::ShaderType { egl::Fragment , egl::Vertex , egl::Geometry , egl::TessEvaluation , egl::TessControl , egl::Compute }

  ShaderType enum to indicate usage.

Functions

- constexpr std::string egl::shaderTypeToString (ShaderType type)

  Converts the ShaderType enum into a std::string.
- unsigned int egl::toGLenum (ShaderType type)

  Converts the ShaderType enum into an OpenGL enum.

9.8 shader.h

Go to the documentation of this file.

```
00001 #ifndef EGL_SHADER_H
00002 #define EGL_SHADER_H
00003
00004 #include <string>
00005 #include <stdexcept>
00006 #include <iosfwd> // std::istream forward-declared
00007
00008 namespace egl {
00009
00010 class Program;
00011
00015 enum class ShaderType {
00016     Fragment,
00017     Vertex,
00018     Geometry,
00019     TessEvaluation,
00020     TessControl,
00021     Compute
00022 };
00023
00030 constexpr std::string shaderTypeToString(ShaderType type);
00031
00040 unsigned int toGLenum(ShaderType type);
00041
00045 class ShaderCompileError : public std::runtime_error {
00046 public:
00053     ShaderCompileError(ShaderType ShaderType,
00054                        const std::string& infoLog)
00055         : std::runtime_error(
00056               "Shader compile failed (" + shaderTypeToString(ShaderType) + "):\n" + infoLog) {}
00057 };
00058
00066 class Shader {
00067 protected:
```

```
00068     unsigned int _id = 0;
00069     ShaderType _type;
00070     bool _compiled = false;
00071
00072     void _delete();
00073     void _check();
00074     void _ensure();
00075     std::string _getError();
00076
00077 public:
00078     Shader() = delete;
00085     Shader(ShaderType type);
00094     Shader(ShaderType type, const char* src);
00103     Shader(ShaderType type, const std::string& src);
00113     Shader(ShaderType type, std::istream& in);
00114
00115     Shader(Shader&& other);
00116     Shader(const Shader& other) = delete; // OpenGL Shaders are not copy safe
00117     ~Shader() noexcept;
00118
00127     void reset();
00128
00132     bool compiled() const { return _compiled; }
00133
00137     ShaderType getType() const { return _type; }
00138
00148     void compile(const char* src);
00149
00161     void compile(std::istream& in);
00162
00173     void compile(const std::string& str);
00174
00175     friend Program;
00176
00177     Shader& operator=(Shader&& other);
00178     Shader& operator=(const Shader& other) = delete; // OpenGL Shaders are not copy safe
00179 };
00180
00181 }
00182
00183 #endif
```

9.9 inc/EGL/vertexBuffer.h File Reference

Data Structures

- class egl::VertexBuffer

Namespaces

- namespace egl

9.10 vertexBuffer.h

Go to the documentation of this file.

```
00001 #ifndef EGL_VERTEX_BUFFER_H
00002 #define EGL_VERTEX_BUFFER_H
00003
00004 namespace egl {
00005
00006 class VertexBuffer {
00007
00008 };
00009
00010 }
00011
00012 #endif
```

Index