Doxygen 1.9.1

1 GNU LESSER GENERAL PUBLIC LICENSE

Version 3, 29 June 2007

This version of the GNU Lesser General Public License incorporates the terms and conditions of version 3 of the GNU General Public License, supplemented by the additional permissions listed below.

1.0.0.1 0. Additional Definitions. As used herein, "this License" refers to version 3 of the GNU Lesser General Public License, and the "GNU GPL" refers to version 3 of the GNU General Public License.

"The Library" refers to a covered work governed by this License, other than an Application or a Combined Work as defined below.

An "Application" is any work that makes use of an interface provided by the Library, but which is not otherwise based on the Library. Defining a subclass of a class defined by the Library is deemed a mode of using an interface provided by the Library.

A "Combined Work" is a work produced by combining or linking an Application with the Library. The particular version of the Library with which the Combined Work was made is also called the "Linked Version".

The "Minimal Corresponding Source" for a Combined Work means the Corresponding Source for the Combined Work, excluding any source code for portions of the Combined Work that, considered in isolation, are based on the Application, and not on the Linked Version.

The "Corresponding Application Code" for a Combined Work means the object code and/or source code for the Application, including any data and utility programs needed for reproducing the Combined Work from the Application, but excluding the System Libraries of the Combined Work.

1.0.0.2 1. Exception to Section 3 of the GNU GPL. You may convey a covered work under sections 3 and 4 of this License without being bound by section 3 of the GNU GPL.

1.0.0.3 2. Conveying Modified Versions. If you modify a copy of the Library, and, in your modifications, a facility refers to a function or data to be supplied by an Application that uses the facility (other than as an argument passed when the facility is invoked), then you may convey a copy of the modified version:

- a) under this License, provided that you make a good faith effort to ensure that, in the event an Application does not supply the function or data, the facility still operates, and performs whatever part of its purpose remains meaningful, or
- b) under the GNU GPL, with none of the additional permissions of this License applicable to that copy.

1.0.0.4 3. Object Code Incorporating Material from Library Header Files. The object code form of an Application may incorporate material from a header file that is part of the Library. You may convey such object code under terms of your choice, provided that, if the incorporated material is not limited to numerical parameters, data structure layouts and accessors, or small macros, inline functions and templates (ten or fewer lines in length), you do both of the following:

- a) Give prominent notice with each copy of the object code that the Library is used in it and that the Library and its use are covered by this License.
- b) Accompany the object code with a copy of the GNU GPL and this license document.

1.0.0.5 4. Combined Works. You may convey a Combined Work under terms of your choice that, taken together, effectively do not restrict modification of the portions of the Library contained in the Combined Work and reverse engineering for debugging such modifications, if you also do each of the following:

- a) Give prominent notice with each copy of the Combined Work that the Library is used in it and that the Library and its use are covered by this License.
- b) Accompany the Combined Work with a copy of the GNU GPL and this license document.
- c) For a Combined Work that displays copyright notices during execution, include the copyright notice for the Library among these notices, as well as a reference directing the user to the copies of the GNU GPL and this license document.
- d) Do one of the following:
  - 0) Convey the Minimal Corresponding Source under the terms of this License, and the Corresponding Application Code in a form suitable for, and under terms that permit, the user to recombine or relink the Application with a modified version of the Linked Version to produce a modified Combined Work, in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.
  - 1) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (a) uses at run time a copy of the Library already present on the user's computer system, and (b) will operate properly with a modified version of the Library that is interface-compatible with the Linked Version.
- e) Provide Installation Information, but only if you would otherwise be required to provide such information under section 6 of the GNU GPL, and only to the extent that such information is necessary to install and execute a modified version of the Combined Work produced by recombining or relinking the Application with a modified version of the Linked Version. (If you use option 4d0, the Installation Information must accompany the Minimal Corresponding Source and Corresponding Application Code. If you use option 4d1, you must provide the Installation Information in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.)

1.0.0.6 5. Combined Libraries. You may place library facilities that are a work based on the Library side by side in a single library together with other library facilities that are not Applications and are not covered by this License, and convey such a combined library under terms of your choice, if you do both of the following:

- a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities, conveyed under the terms of this License.
- b) Give prominent notice with the combined library that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

1.0.0.7 6. Revised Versions of the GNU Lesser General Public License. The Free Software Foundation may publish revised and/or new versions of the GNU Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library as you received it specifies that a certain numbered version of the GNU Lesser General Public License "or any later version" applies to it, you have the option of following the terms and conditions either of that published version or of any later version published by the Free Software Foundation. If the Library as you received it does not specify a version number of the GNU Lesser General Public License, you may choose any version of the GNU Lesser General Public License ever published by the Free Software Foundation.

If the Library as you received it specifies that a proxy can decide whether future versions of the GNU Lesser General Public License shall apply, that proxy's public statement of acceptance of any version is permanent authorization for you to choose that version for the Library.

2

2.1

.

3

3.1

4

4.1

, , ' .

Beziator
7

Bijective
';
13

Buffer
,
18

Camera
,
22

Context
, '
32

Framebuffer
,
36

GlBindable
, ' ' OpenGL
44

GlBinder
' ' OpenGL
53

5

5.1

.

6

6.1 OSDO

osdo

- class vector
  .

6.1.1

osdo

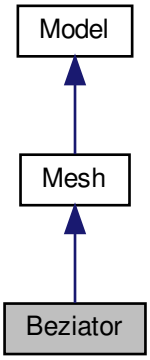
7

7.1 Beziator

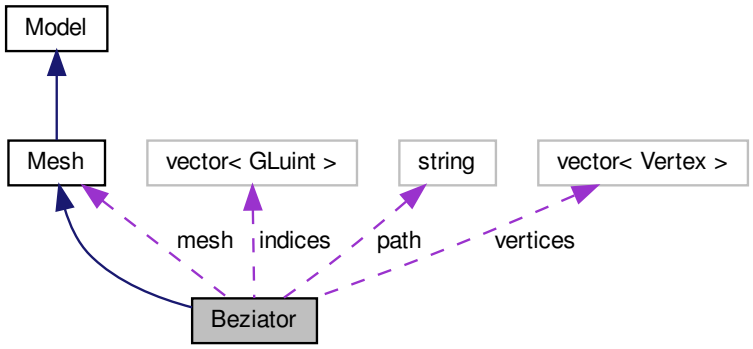
.

#include <beziator.h>

Beziator



' Beziator:



- typedef surfacei_t * surfaces_vector
  .

- Beziator (const string &path)
  Beziator, .
- ~Beziator () override
- bool init ()
  '.

- void draw (Shader &shader, bool pre_generated) override
  .
- void generate (size_t d=8) override
  .
- bool save ()
  , path.
- void rotate (size_t i)
  , .
- vector< Vertex > * get_vertices () override
  .

- const string path
  .
- Mesh mesh
  CPU .
- vector< Vertex > vertices
  / .
- vector< GLuint > indices
  , .

7.1.1

.

. beziator.h, 22

7.1.2

7.1.2.1 surfaces_vector typedef surfacei_t* Beziator::surfaces_vector

.

. beziator.h, 27

7.1.3 ()

7.1.3.1 Beziator() Beziator::Beziator (const string & path)

Beziator, .

' Beziator::init '.

path	.

. beziator.cpp, 18

7.1.3.2 ~Beziator() Beziator::~Beziator ( ) [override]

. beziator.cpp, 58

7.1.4

7.1.4.1 draw() void Beziator::draw (
Shader & shader,
bool pre_generated) [override], [virtual]

.

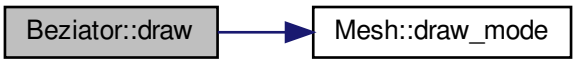
pre_generated , false, 4x4, true, .

shader	.
pre_generated	, .

Model.

. beziator.cpp, 61

:



7.1.4.2 generate() void Beziator::generate (
size_t d = 8) [override], [virtual]

.

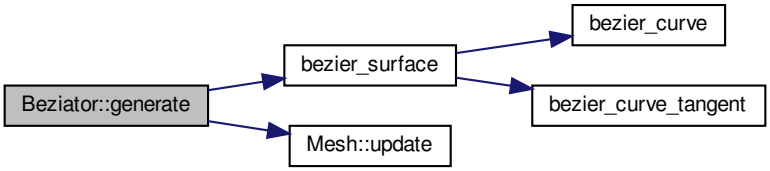
d , 8, 8x8=64 .

d	.

Model.

. beziator.cpp, 136

:



7.1.4.3 get_vertices() vector< Vertex > * Beziator::get_vertices ( ) [override], [virtual]

.

vertices.

Model.

. beziator.cpp, 287

7.1.4.4 init() bool Beziator::init ( )

'.

, .

. beziator.cpp, 20

:

7.1.4.5 rotate() void Beziator::rotate (size_t i)

, .

i	.

. beziator.cpp, 277

7.1.4.6 save() bool Beziator::save ( )

, path.

.

. beziator.cpp, 110

7.1.5

7.1.5.1 indices vector<GLuint> Beziator::indices [protected]

, .

16 , 4x4. surfaces_vector:

```
surfacei_t *surfaces = reinterpret_cast<surfacei_t*>(indices.data());
```

. beziator.h, 52

7.1.5.2 mesh Mesh Beziator::mesh [protected]

CPU .

. beziator.h, 36

7.1.5.3 path const string Beziator::path [protected]

.

. beziator.h, 32

7.1.5.4 vertices vector<Vertex> Beziator::vertices [protected]

/ .

. beziator.h, 42

:

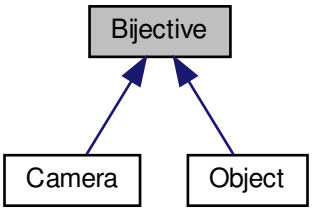
- osdo/beziator.h
- osdo/beziator.cpp

7.2 Bijective

', .

#include <bijective.h>

Bijective



- virtual ~Bijective ()
- virtual void get_position (vec4 position)
  ' .
- virtual void set_position (vec4 position)
  ' .
- virtual void get_rotation (vec3 rotation)
  '.
- virtual void set_rotation (vec3 rotation)
  '.
- virtual void get_animation (vec3 rotation)
  '.
- virtual void set_animation (vec3 rotation)
  '.
- virtual void get_mat4 (mat4 matrix)
  '.
- virtual void translate (vec3 distances, float delta_time)
  ' .
- virtual void rotate (enum coord_enum coord, float delta_time)
  '.
- virtual void rotate_all (vec3 angles)
  ' .
- virtual void add_animation (vec3 angles, float delta_time)
  '.

7.2.1

', .

. bijective.h, 13

7.2.2 ()

7.2.2.1 ~Bijective() virtual Bijective::~Bijective ( ) [inline], [virtual]

. bijective.h, 15

7.2.3

7.2.3.1 add_animation() virtual void Bijective::add_animation (
vec3 angles,
float delta_time) [inline], [virtual]

'.

in	angles	
in	delta_time	

Object Camera.

. bijective.h, 81

7.2.3.2 get_animation() virtual void Bijective::get_animation (vec3 rotation) [inline], [virtual]

'.

out	rotation	'

Object Camera.

. bijective.h, 43

7.2.3.3 get_mat4() virtual void Bijective::get_mat4 (mat4 matrix) [inline], [virtual]

'.

out	matrix	

Object Camera.

. bijective.h, 54

7.2.3.4 get_position() virtual void Bijective::get_position (vec4 position) [inline], [virtual]

' .

out	position	'

Object Camera.

. bijective.h, 21

7.2.3.5 get_rotation() virtual void Bijective::get_rotation (
vec3 rotation) [inline], [virtual]

'.

out	rotation	'

Object Camera.

. bijective.h, 32

7.2.3.6 rotate() virtual void Bijective::rotate (
enum coord_enum coord,
float delta_time) [inline], [virtual]

'.

in	coord	
in	delta_time	

Object Camera.

. bijective.h, 70

7.2.3.7 rotate_all() virtual void Bijective::rotate_all (
vec3 angles) [inline], [virtual]

' .

in	angles	

Object Camera.

. bijective.h, 75

7.2.3.8 set_animation() virtual void Bijective::set_animation (vec3 rotation) [inline], [virtual]

'.

in	rotation	'.

Object Camera.

. bijective.h, 48

7.2.3.9 set_position() virtual void Bijective::set_position (vec4 position) [inline], [virtual]

' .

in	position	'

Object Camera.

. bijective.h, 26

7.2.3.10 set_rotation() virtual void Bijective::set_rotation (vec3 rotation) [inline], [virtual]

'.

in	rotation	'

Object Camera.

. bijective.h, 37

7.2.3.11 translate() virtual void Bijective::translate (vec3 distances, float delta_time) [inline], [virtual]

' .

' distances, .

in	distances	
in	delta_time	

Object Camera.

. bijective.h, 64

:

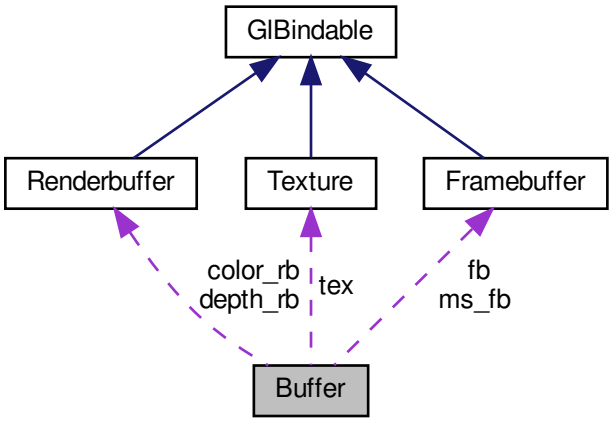
- osdo/bijective.h

7.3 Buffer

, .

#include <buffer.h>

' Buffer:



- bool pre_render (GLsizei size[2])

.

- void post_render (GLsizei size[2])

.

- const Texture & get_tex ()

.

- Texture tex
  .
- Renderbuffer color_rb
  .
- Renderbuffer depth_rb
  .
- Framebuffer ms_fb
  .
- Framebuffer fb
  .

7.3.1

, .

. buffer.h, 16

7.3.2

7.3.2.1 get_tex() const Texture & Buffer::get_tex ( )

.

. buffer.cpp, 35

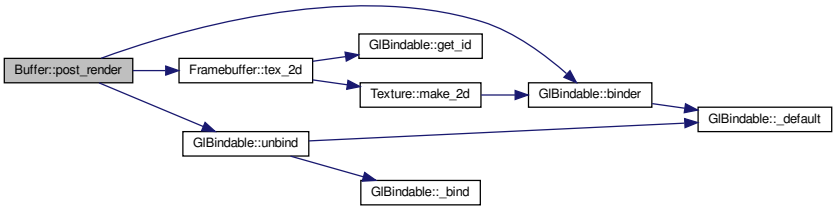
7.3.2.2 post_render() void Buffer::post_render (GLsizei size[2])

.

in	size	.

. buffer.cpp, 21

:



7.3.2.3 pre_render() bool Buffer::pre_render (GLsizei size[2])

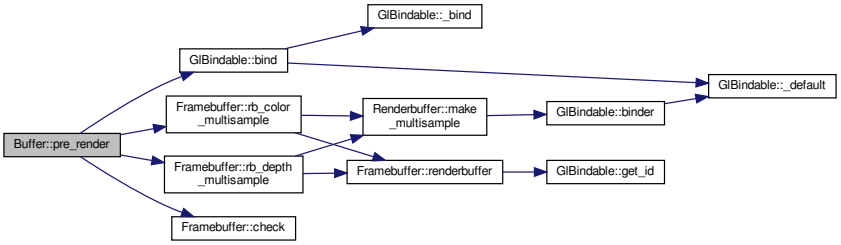
.

in	size	.

.

. buffer.cpp, 6

:



7.3.3

7.3.3.1 color_rb Renderbuffer Buffer::color_rb [private]

.

. buffer.h, 24

7.3.3.2 depth_rb Renderbuffer Buffer::depth_rb [private]

.

. buffer.h, 28

7.3.3.3 fb Framebuffer Buffer::fb [private]

.

. buffer.h, 36

7.3.3.4 ms_fb Framebuffer Buffer::ms_fb [private]

.

. buffer.h, 32

7.3.3.5 tex Texture Buffer::tex [private]

.

. buffer.h, 20

:

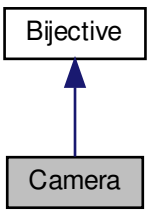
- osdo/buffer.h
- osdo/buffer.cpp

7.4 Camera

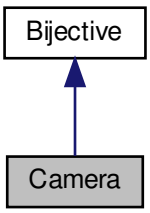
, .

#include <camera.h>

Camera



' Camera:



- Camera ()
- void get_position (vec4 position) override
  .
- void set_position (vec4 position) override
  .
- void get_rotation (vec3 rotation) override
  .
- void set_rotation (vec3 rotation) override
  .
- void get_animation (vec3 animation) override
  Bijective
- void set_animation (vec3 animation) override
  Bijective
- void get_mat4 (mat4 matrix) override
  .
- void translate (vec3 distances, float delta_time) override
  .
- void rotate (enum coord_enum coord, float delta_time) override
  .
- void rotate_all (vec3 angles) override
  .
- void add_animation (vec3 angles, float delta_time) override
  Bijective
- void get_direction (vec4 dest)
  .
- void get_rotation_mat4 (mat4 dest)
  .
- void get_rotation_inv_mat4 (mat4 dest)
  .
- void translate_camera (vec3 distances)
  .
- void rotate_camera (float angle, enum coord_enum coord)
  .
- void rotate_all_camera (vec3 angles)
  .
- void rotate_all_inverse (vec3 angles)
  .

- mat4 rotation
  .
- vec4 position
  $(x, y, z, 1.0)$.
- vec4 animation
  , Bijective

7.4.1

, .

. camera.h, 19

7.4.2 ()

7.4.2.1 Camera() Camera::Camera ( )

. camera.cpp, 6

7.4.3

7.4.3.1 add_animation() void Camera::add_animation (
vec3 angles,
float delta_time) [override], [virtual]

Bijective

Bijective.

. camera.cpp, 69

7.4.3.2 get_animation() void Camera::get_animation (
vec3 animation) [override], [virtual]

Bijective

Bijective.

. camera.cpp, 31

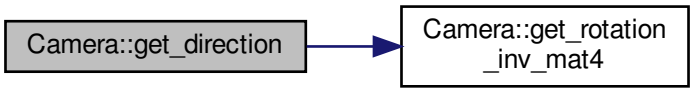
7.4.3.3 get_direction() void Camera::get_direction (
vec4 dest)

.

out	dest	

. camera.cpp, 77

:



7.4.3.4 get_mat4() void Camera::get_mat4 (mat4 matrix) [override], [virtual]

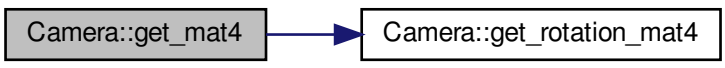
.

out	matrix	

Bijective.

. camera.cpp, 41

:



7.4.3.5 get_position() void Camera::get_position (vec4 position) [override], [virtual]

.

out	position	

Bijective.

7.4.3.6 get_rotation() void Camera::get_rotation (vec3 rotation) [override], [virtual]

.

out	rotation	

Bijective.

. camera.cpp, 21

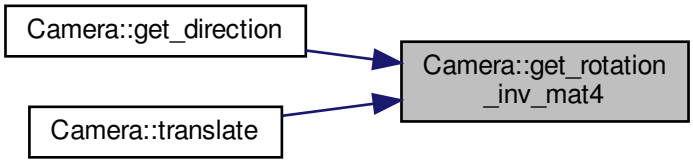
7.4.3.7 get_rotation_inv_mat4() void Camera::get_rotation_inv_mat4 (mat4 dest)

.

out	dest	.

. camera.cpp, 88

:



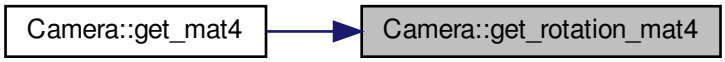
7.4.3.8 get_rotation_mat4() void Camera::get_rotation_mat4 (mat4 dest)

.

out	dest	.

. camera.cpp, 83

:



7.4.3.9 rotate() void Camera::rotate (enum coord_enum coord, float delta_time) [override], [virtual]

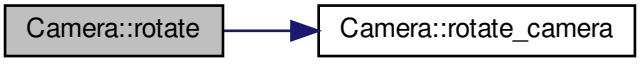
.

in	coord	
in	delta_time	

Bijective.

. camera.cpp, 58

:



7.4.3.10 rotate_all() void Camera::rotate_all (vec3 angles) [override], [virtual]

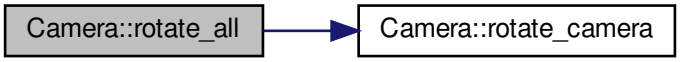
.

in	angles	

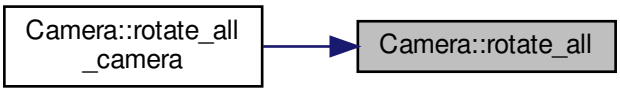
Bijective.

. camera.cpp, 63

:



:



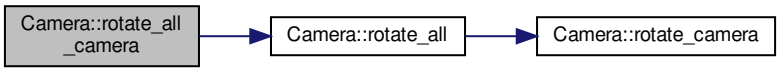
7.4.3.11 rotate_all_camera() void Camera::rotate_all_camera (vec3 angles)

.

angles	(x, y, z)

. camera.cpp, 110

:



7.4.3.12 rotate_all_inverse() void Camera::rotate_all_inverse (vec3 angles)

.

angles	(x, y, z)

. camera.cpp, 114

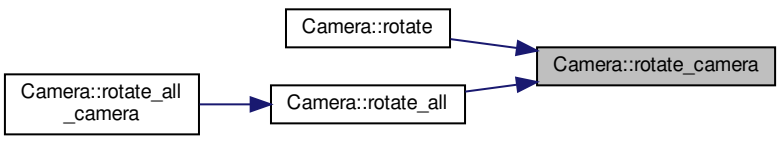
7.4.3.13 rotate_camera() void Camera::rotate_camera (float angle, enum coord_enum coord)

.

angle	
coord	

. camera.cpp, 96

:



7.4.3.14 set_animation() void Camera::set_animation (vec3 animation) [override], [virtual]

Bijective

Bijective.

. camera.cpp, 36

7.4.3.15 set_position() void Camera::set_position (vec4 position) [override], [virtual]

.

in	position	

Bijective.

. camera.cpp, 16

7.4.3.16 set_rotation() void Camera::set_rotation (vec3 rotation) [override], [virtual]

.

in	rotation	

Bijective.

. camera.cpp, 26

7.4.3.17 translate() void Camera::translate (vec3 distances, float delta_time) [override], [virtual]

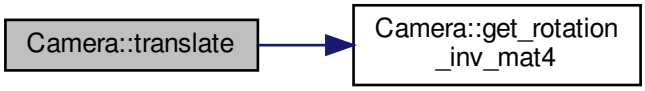
.

in	distances	
in	delta_time	

Bijective.

. camera.cpp, 46

:



7.4.3.18 translate_camera() void Camera::translate_camera (vec3 distances)

.

distances	(x, y, z)

. camera.cpp, 92

7.4.4

7.4.4.1 animation vec4 Camera::animation [private]

, Bijective

. camera.h, 31

7.4.4.2 position vec4 Camera::position [private]

$(x, y, z, 1.0)$.

. camera.h, 27

7.4.4.3 rotation mat4 Camera::rotation [private]

.

. camera.h, 23

:

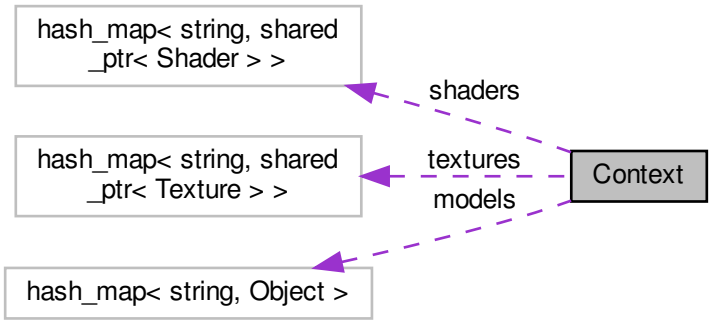
- osdo/camera.h
- osdo/camera.cpp

7.5 Context

, '.

#include <context.h>

' Context:



- typedef hash_map< string, Object > Models
  .
- typedef hash_map< string, shared_ptr< Texture > > Textures
  .

- Context ()
- Models::iterator & next_active ()
  .
- void load_texture (const char *path)
  '.
- bool load_shader (const char *name, const Shader::shader_map &shaders)
  .
- bool load_model (const string &path)

- Models models
  .
- hash_map< string, shared_ptr< Shader > > shaders
  .
- Textures textures
  .
- Models::iterator active
  .
- Textures::iterator active_texture
  .

7.5.1

, ' .

. context.h, 26

7.5.2

7.5.2.1 Models typedef hash_map<string, Object> Context::Models

.

. context.h, 31

7.5.2.2 Textures typedef hash_map<string, shared_ptr<Texture> > Context::Textures

.

. context.h, 35

7.5.3 ()

7.5.3.1 Context() Context::Context ( )

. context.cpp, 6

7.5.4

7.5.4.1 load_model() bool Context::load_model (
const string & path)

path	

7.5.4.2 load_shader()

bool Context::load_shader (
const char * name,
const Shader::shader_map & shaders)

.

name	
shaders	

. context.cpp, 26

:

7.5.4.3 load_texture()

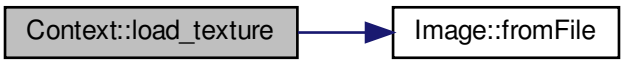
void Context::load_texture (
const char * path)

'.

in	path	

. context.cpp, 17

:



7.5.4.4 next_active() Context::Models::iterator & Context::next_active ( )

.

. context.cpp, 10

7.5.5

7.5.5.1 active Models::iterator Context::active

.

. context.h, 52

7.5.5.2 active_texture Textures::iterator Context::active_texture

.

. context.h, 56

7.5.5.3 models Models Context::models

.

. context.h, 39

7.5.5.4 shaders hash_map<string, shared_ptr<Shader> > Context::shaders

.

. context.h, 43

7.5.5.5 textures Textures Context::textures

.

. context.h, 47

:

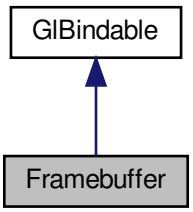
- osdo/context.h
- osdo/context.cpp

7.6 Framebuffer

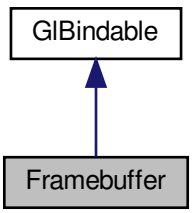
, .

#include <framebuffer.h>

Framebuffer



' Framebuffer:



- Framebuffer ()
- ~Framebuffer () override
- bool check (GLenum target=GL_FRAMEBUFFER)
  , .
- void tex_2d_multisample (GLsizei size[2], const Texture &texture)
- void tex_2d (GLsizei size[2], const Texture &texture)
- void renderbuffer (const Renderbuffer &rb, GLenum target) const
  rb
- void rb_color_multisample (GLsizei size[2], const Renderbuffer &rb) const
  .
- void rb_depth_multisample (GLsizei size[2], const Renderbuffer &rb) const
  .
- void rb_color (GLsizei size[2], const Renderbuffer &rb) const
  .
- void rb_depth (GLsizei size[2], const Renderbuffer &rb) const
  .

- GLuint _generate () const override
  .
- virtual void _bind (const GLuint id, GLenum target) const override
  , ' .
- virtual GLenum _default () const override
  , ' .

7.6.1

, .

. framebuffer.h, 17

7.6.2 ()

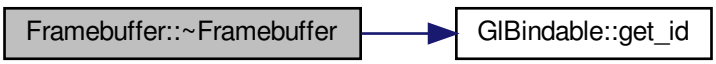
7.6.2.1 Framebuffer() Framebuffer::Framebuffer ( )

. framebuffer.cpp, 22

7.6.2.2 ~Framebuffer() Framebuffer::~Framebuffer ( ) [override]

. framebuffer.cpp, 24

:



7.6.3

7.6.3.1 _bind() void Framebuffer::_bind (
const GLuint id,
GLenum target) const [override], [private], [virtual]

, ' .

id	
target	

GlBindable.

. framebuffer.cpp, 12

7.6.3.2 _default() GLenum Framebuffer::_default ( ) const [override], [private], [virtual]

, ' .

'

GlBindable.

. framebuffer.cpp, 17

7.6.3.3 _generate() GLuint Framebuffer::_generate ( ) const [override], [private], [virtual]

.

GlBindable.

. framebuffer.cpp, 5

7.6.3.4 check() bool Framebuffer::check (GLenum target = GL_FRAMEBUFFER)

, .

target	

. framebuffer.cpp, 28

:

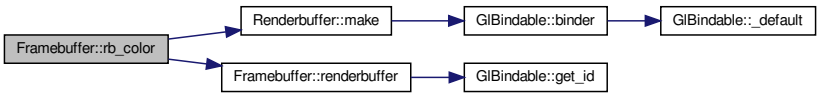
7.6.3.5 rb_color() void Framebuffer::rb_color (GLsizei size[2], const Renderbuffer & rb) const

.

size	
rb	

. framebuffer.cpp, 61

:



7.6.3.6 rb_color_multisample()

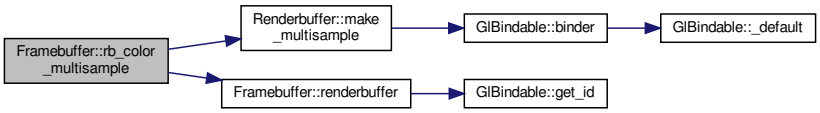
void Framebuffer::rb_color_multisample (
GLsizei size[2],
const Renderbuffer & rb) const

.

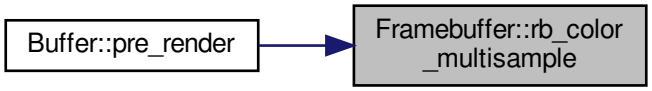
size	
rb	

. framebuffer.cpp, 49

:



:



7.6.3.7 rb_depth()

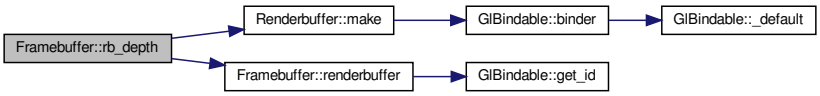
void Framebuffer::rb_depth (
GLsizei size[2],
const Renderbuffer & rb) const

.

size	
rb	

. framebuffer.cpp, 67

:



7.6.3.8 rb_depth_multisample()

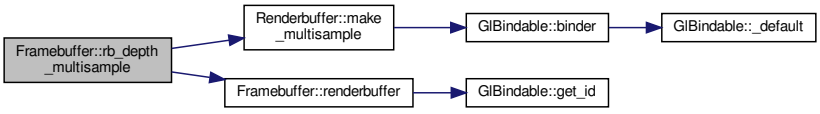
void Framebuffer::rb_depth_multisample (
GLsizei size[2],
const Renderbuffer & rb) const

.

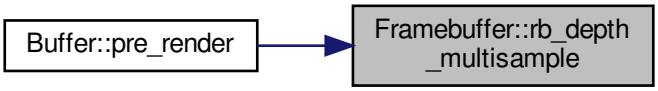
size	
rb	

. framebuffer.cpp, 55

:



:



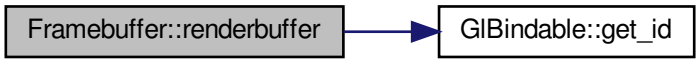
7.6.3.9 renderbuffer() void Framebuffer::renderbuffer (
const Renderbuffer & rb,
GLenum target) const

rb

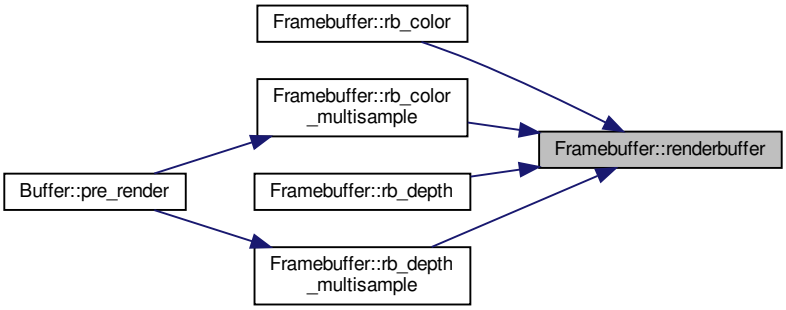
rb	
target	

. framebuffer.cpp, 44

:



:

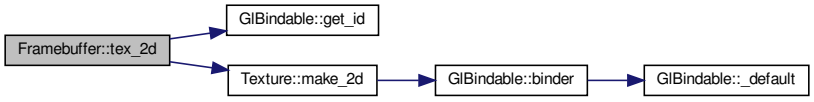


7.6.3.10 tex_2d() void Framebuffer::tex_2d (
GLsizei size[2],
const Texture & texture)

size	
texture	

. framebuffer.cpp, 38

:



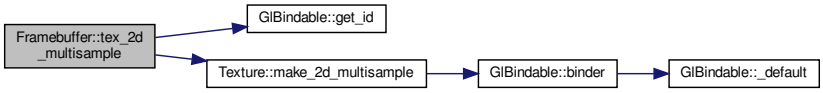
:

7.6.3.11 tex_2d_multisample() void Framebuffer::tex_2d_multisample (
GLsizei size[2],
const Texture & texture)

size	
texture	

. framebuffer.cpp, 32

:



:

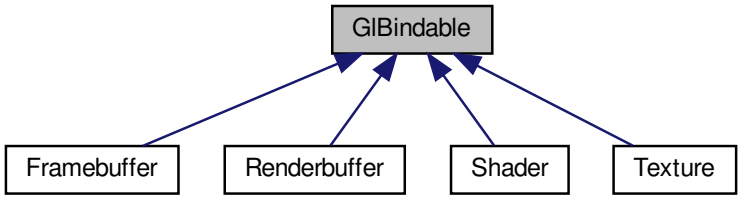
- osdo/framebuffer.h
- osdo/framebuffer.cpp

7.7 GlBindable

, ' ' OpenGL.

#include <glbindable.h>

GlBindable



- virtual ~GlBindable ()
- GlBindable (const GlBindable &)=delete
- GlBindable (GlBindable &&)=delete
- GlBindable & operator= (const GlBindable &)=delete
- GlBindable & operator= (GlBindable &&)=delete
- const GLuint & get_id () const
  'OpenGL.
- void * get_vid () const
  'OpenGL void*
- void bind () const
  ' '.
- void bind (GLenum target) const
  ' ' target
- void unbind () const
  ' '.
- void unbind (GLenum target) const
  ' ' target
- GlBinder binder () const
  ''
- GlBinder binder (GLenum target) const
  '' target

- virtual GLuint _generate () const
  '.
- virtual void _bind (const GLuint id, GLenum target) const
  , ' OpenGL '.
- virtual GLenum _default () const
  , '.
- GlBindable ()
- GlBindable (const GLuint id)
  .

- const GLuint id
  'OpenGL.

7.7.1

, '' OpenGL.

. glbindable.h, 15

7.7.2 ()

7.7.2.1 GlBindable() [1/4] GlBindable::GlBindable ( ) [protected]

. glbindable.cpp, 14

7.7.2.2 GlBindable() [2/4] GlBindable::GlBindable (const GLuint id) [protected]

.

id	' OpenGL

. glbindable.cpp, 16

7.7.2.3 ~GlBindable() GlBindable::~GlBindable ( ) [virtual]

. glbindable.cpp, 18

7.7.2.4 GlBindable() [3/4] GlBindable::GlBindable (const GlBindable &) [delete]

7.7.2.5 GlBindable() [4/4] GlBindable::GlBindable (GlBindable &&) [delete]

7.7.3

7.7.3.1 _bind() void GlBindable::_bind (const GLuint id, GLenum target) const [protected], [virtual]

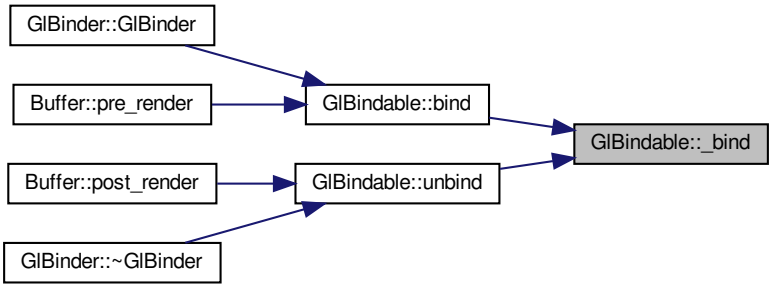
, ' OpenGL '.

id	' OpenGL
target	' '

Texture, Shader, Renderbuffer Framebuffer.

. glbindable.cpp, 8

:



7.7.3.2 _default() GLenum GlBindable::_default ( ) const [protected], [virtual]

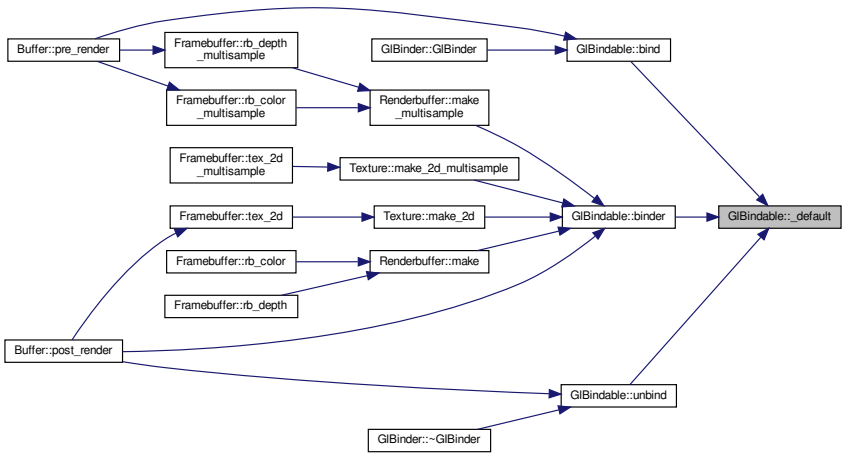
, ' .

'

Texture, Renderbuffer Framebuffer.

. glbindable.cpp, 10

:



7.7.3.3 _generate() GLuint GlBindable::_generate ( ) const [protected], [virtual]

'.

' OpenGL

Texture, Renderbuffer Framebuffer.

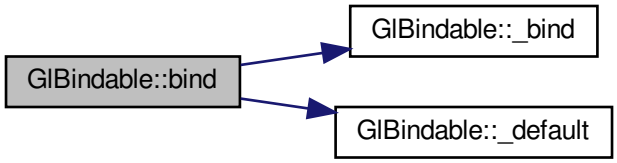
. glbindable.cpp, 4

7.7.3.4 bind() [1/2] void GlBindable::bind ( ) const

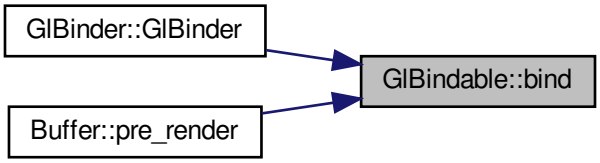
' ' .

. glbindable.cpp, 30

:



:



7.7.3.5 bind() [2/2] void GlBindable::bind (GLenum target) const

' ' target

target	''

. glbindable.cpp, 35

:

7.7.3.6 binder() [1/2] GlBinder GlBindable::binder ( ) const

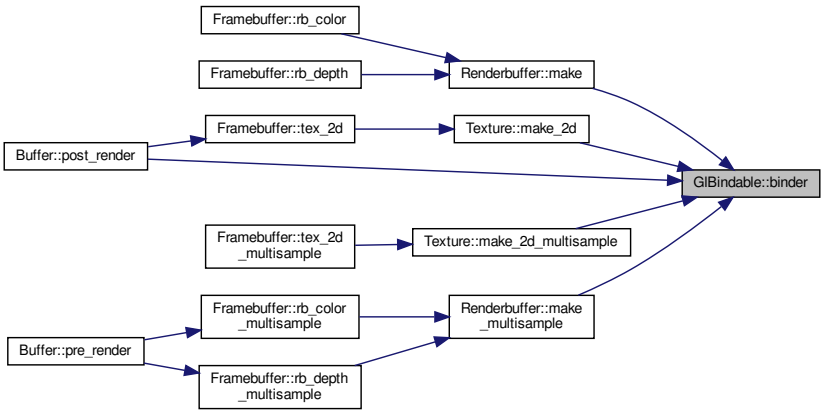
''

''

. glbindable.cpp, 50

:

:



7.7.3.7 binder() [2/2] GlBinder GlBindable::binder (GLenum target) const

' ' target

target	' '

' ' target

. glbindable.cpp, 55

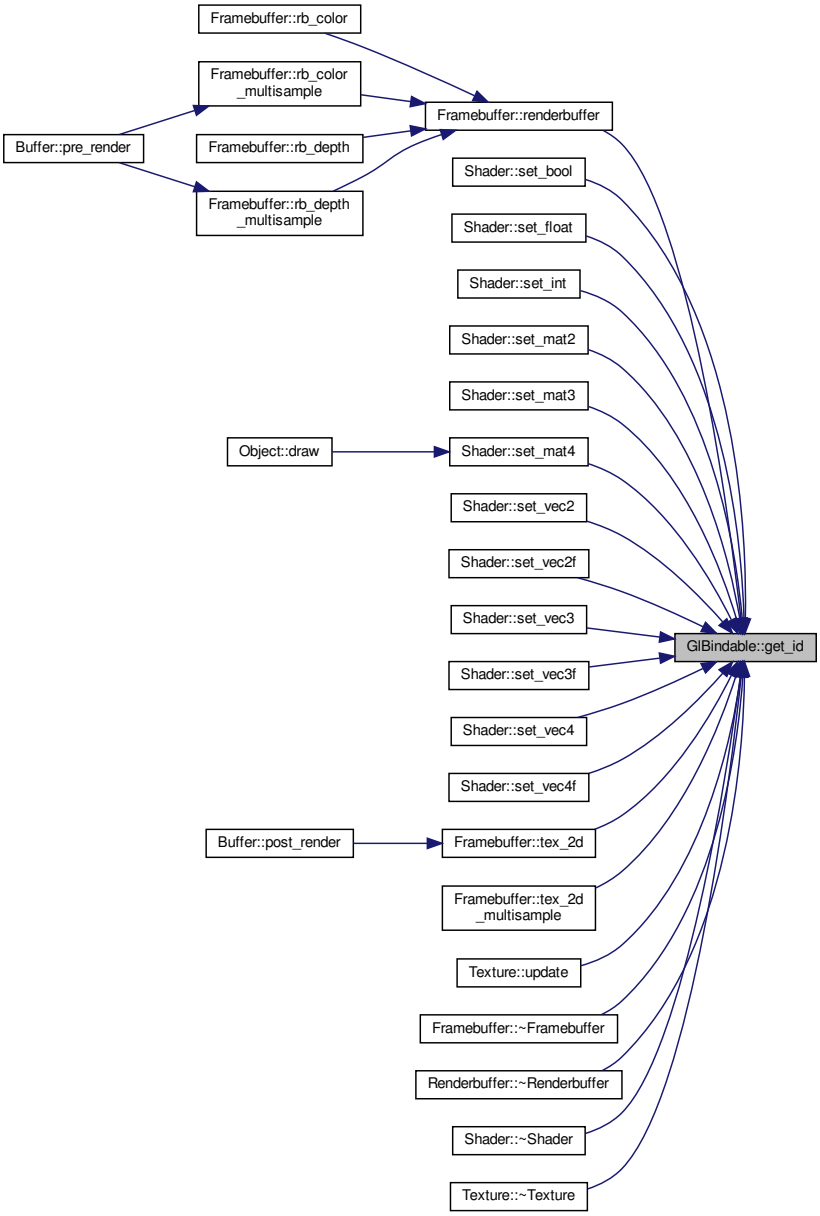
7.7.3.8 get_id() const GLuint & GlBindable::get_id ( ) const

' OpenGL.

' OpenGL

. glbindable.cpp, 20

:



7.7.3.9 get_vid() void * GlBindable::get_vid ( ) const

' OpenGL void*

' OpenGL

. glbindable.cpp, 25

7.7.3.10 operator=() [1/2] GlBindable& GlBindable::operator= (const GlBindable &) [delete]

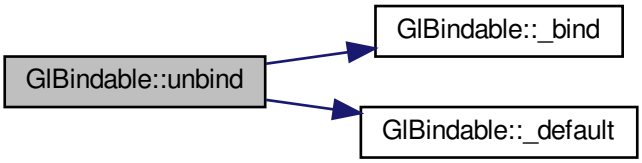
7.7.3.11 operator=() [2/2] GlBindable& GlBindable::operator= (GlBindable &&) [delete]

7.7.3.12 unbind() [1/2] void GlBindable::unbind ( ) const

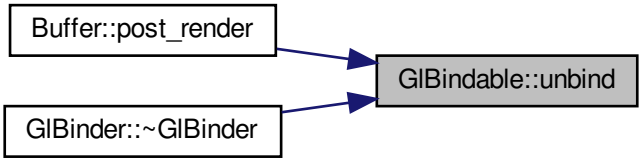
' ' .

. glbindable.cpp, 40

:



:



7.7.3.13 unbind() [2/2] void GlBindable::unbind (GLenum target) const

' ' target

target	' '

. glbindable.cpp, 45

:

7.7.4

7.7.4.1 id const GLuint GlBindable::id [private]

' OpenGL.

. glbindable.h, 20

:

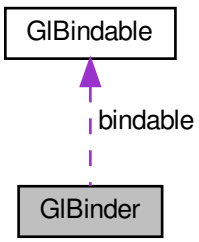
- osdo/glbindable.h
- osdo/glbindable.cpp

7.8 GlBinder

' ' OpenGL.

#include <glbinder.h>

' GlBinder:



- GlBinder (const GlBindable &bindable, GLenum target)
- ~GlBinder ()

- const GlBindable & bindable
  ' OpenGL, '.
- const GLenum target
  '.

7.8.1

' ' OpenGL.

. glbinder.h, 15

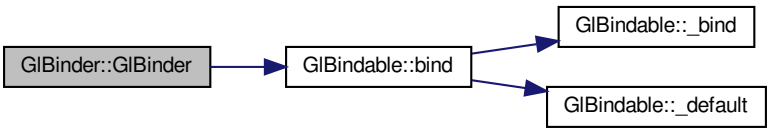
7.8.2 ()

7.8.2.1 GlBinder() GlBinder::GlBinder (
const GlBindable & bindable,
GLenum target)

bindable	' OpenGL, '
target	'

. glbinder.cpp, 5

:



7.8.2.2 ~GlBinder() GlBinder::~GlBinder ( )

. glbinder.cpp, 10

:

7.8.3

7.8.3.1 bindable const GlBindable& GlBinder::bindable [private]

' OpenGL, '.

. glbinder.h, 20

7.8.3.2 target const GLenum GlBinder::target [private]

'.

. glbinder.h, 24

:

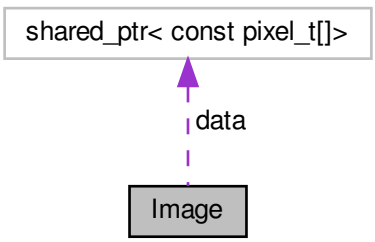
- osdo/glbinder.h
- osdo/glbinder.cpp

7.9 Image

, .

#include <image.h>

' Image:



- Image (shared_ptr< const pixel_t[]> data, const int width, const int height)
  . , .

- static Image fromFile (const char *path)
  .

- shared_ptr< const pixel_t[]> data
  . *.
- const int width
  .
- const int height
  .

7.9.1

, .

. image.h, 36

7.9.2 ()

7.9.2.1 Image() Image::Image (
shared_ptr< const pixel_t[]> data,
const int width,
const int height)

. , .

data	, * .
width	.
height	.

. image.cpp, 9

7.9.3

7.9.3.1 fromFile() Image Image::fromFile (const char * path) [static]

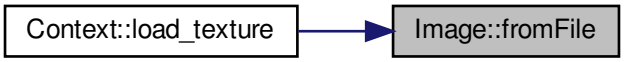
.

path	.

Image, .

. image.cpp, 15

:



7.9.4

7.9.4.1 data shared_ptr<const pixel_t[]> Image::data

. *.

. image.h, 44

7.9.4.2 height const int Image::height

.

. image.h, 52

7.9.4.3 width const int Image::width

.

. image.h, 48

:

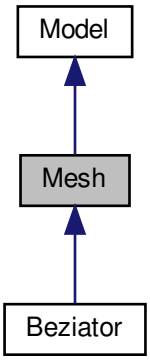
- osdo/image.h
- osdo/image.cpp

7.10 Mesh

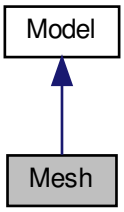
, .

#include <mesh.h>

Mesh



' Mesh:



- Mesh ()
- ~Mesh () override
- Mesh (const Mesh &)=delete
- Mesh (Mesh &&)=delete
- Mesh & operator= (const Mesh &)=delete
- Mesh & operator= (Mesh &&)=delete
- void cube_update ()

  .
- void update (const Vertex *vertices, size_t vertices_n, const GLuint *indices, size_t indices_n)

.

- void draw (Shader &shader, bool pre_generated) override

.

- void draw_mode (GLenum mode)

. . glDrawElements.

- GLuint vao

. "Vertex Array Object".

- GLuint vbo

' . "Vertex Buffer Object".

- GLuint ebo

' . "Element Buffer Objects".

- GLint indices_size

ebo.

7.10.1

, .

. mesh.h, 15

7.10.2 ()

7.10.2.1 Mesh() [1/3] Mesh::Mesh ( )

. mesh.cpp, 5

7.10.2.2 ~Mesh() Mesh::~Mesh ( ) [override]

. mesh.cpp, 40

7.10.2.3 Mesh() [2/3] Mesh::Mesh (const Mesh &) [delete]

7.10.2.4 Mesh() [3/3] Mesh::Mesh (Mesh &&) [delete]

7.10.3

7.10.3.1 cube_update() void Mesh::cube_update ( )

.

. mesh.cpp, 46

7.10.3.2 draw() void Mesh::draw (
Shader & shader,
bool pre_generated) [override], [virtual]

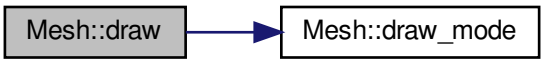
.

shader	.
pre_generated	, .

Model.

. mesh.cpp, 87

:



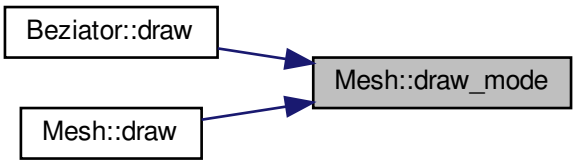
7.10.3.3 draw_mode() void Mesh::draw_mode (
GLenum mode)

. . glDrawElements.

mode	.

. mesh.cpp, 73

:



7.10.3.4 operator=() [1/2]

Mesh& Mesh::operator= (const Mesh &) [delete]

7.10.3.5 operator=() [2/2]

Mesh& Mesh::operator= (Mesh &&) [delete]

7.10.3.6 update()

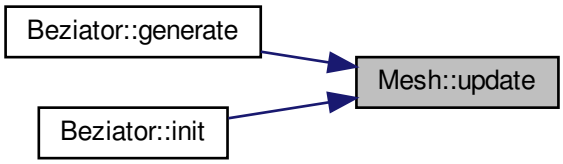
void Mesh::update (const Vertex * vertices, size_t vertices_n, const GLuint * indices, size_t indices_n)

.

vertices		
vertices_n		
indices		
indices_n		

. mesh.cpp, 53

:



7.10.4

7.10.4.1 ebo GLuint Mesh::ebo [protected]

' . "Element Buffer Objects".

. mesh.h, 28

7.10.4.2 indices_size GLint Mesh::indices_size [protected]

ebo.

. mesh.h, 32

7.10.4.3 vao GLuint Mesh::vao [protected]

. "Vertex Array Object".

. mesh.h, 20

7.10.4.4 vbo GLuint Mesh::vbo [protected]

' . "Vertex Buffer Object".

. mesh.h, 24

:

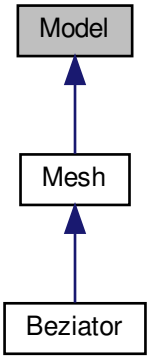
- osdo/mesh.h
- osdo/mesh.cpp

7.11 Model

, .

#include <model.h>

Model



- virtual ~Model ()
- virtual void draw (Shader &shader, bool pre_generated=false)
  .
- virtual void generate (size_t d=8)
  . . Beziator::generate
- virtual vector< Vertex > * get_vertices ()
  .
- virtual void edit_panel ()
  .

7.11.1

, .

. model.h, 18

7.11.2 ()

7.11.2.1 ~Model() Model::~Model ( ) [virtual]

. model.cpp, 4

7.11.3

7.11.3.1 draw() void Model::draw (
Shader & shader,
bool pre_generated = false) [virtual]

.

shader	.
pre_generated	, .

Mesh Beziator.

. model.cpp, 6

7.11.3.2 edit_panel() void Model::edit_panel ( ) [virtual]

.

. model.cpp, 14

7.11.3.3 generate() void Model::generate (
size_t d = 8) [virtual]

. . Beziator::generate

d	.

Beziator.

. model.cpp, 8

7.11.3.4 get_vertices() vector< Vertex > * Model::get_vertices ( ) [virtual]

.

vertices.

Beziator.

. model.cpp, 10

:

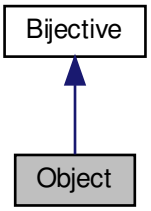
- osdo/model.h
- osdo/model.cpp

7.12 Object

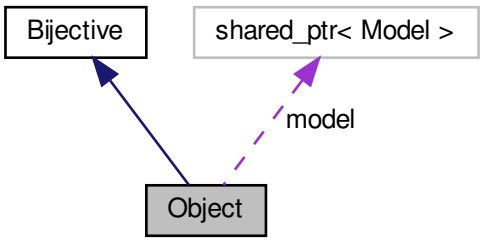
' .

#include <object.h>

Object



' Object:



- Object (shared_ptr< Model > model=nullptr)
  , .
- ~Object () override=default
- void get_position (vec4 position) override
  .
- void set_position (vec4 position) override
  .
- void get_rotation (vec3 rotation) override
  .
- void set_rotation (vec3 rotation) override
  .
- void get_animation (vec3 rotation) override
  .
- void set_animation (vec3 rotation) override
  .
- void get_mat4 (mat4 matrix) override
  .
- void translate (vec3 distances, float delta_time) override
  .
- void rotate (enum coord_enum coord, float delta_time) override
  .
- void rotate_all (vec3 angles) override
  .
- void add_animation (vec3 angles, float delta_time) override
  .
- shared_ptr< Model > get_model ()
  .
- void draw (Shader &shader, mat4 mat4buf, GLdouble delta_time, bool pre_generated)
  .
- void translate_object (vec3 distances)
  .
- void rotate_object (float angle, enum coord_enum coord)
  .
- void rotate_all_object (vec3 angles)
  .
- void animate (float step)
  .
- void scale (vec3 scale)
  .
- mat4 * get_transform ()
  .

- mat4 transform
  .
- vec4 position
  .
- vec4 animation
  $(x, y, z, 1.0)$.
- shared_ptr< Model > model
  .

7.12.1

' .

. object.h, 20

7.12.2 ()

7.12.2.1 Object() Object::Object (
shared_ptr< Model > model = nullptr)

, ' .

model	'.

. object.cpp, 7

7.12.2.2 ~Object() Object::~Object ( ) [override], [default]

7.12.3

7.12.3.1 add_animation() void Object::add_animation (
vec3 angles,
float delta_time) [override], [virtual]

'.

in	angles	
in	delta_time	

Bijective.

. object.cpp, 73

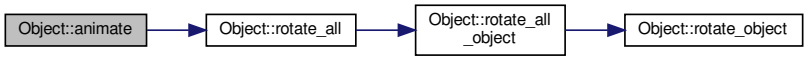
7.12.3.2 animate() void Object::animate (float step)

' .

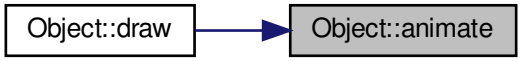
step	

. object.cpp, 105

:



:



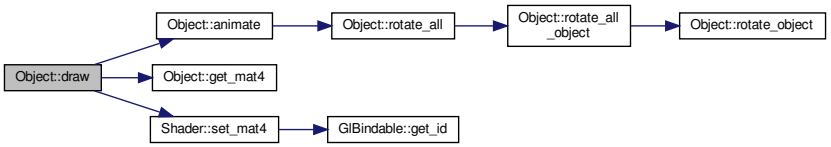
7.12.3.3 draw() void Object::draw (
Shader & shader,
mat4 mat4buf,
GLdouble delta_time,
bool pre_generated)

'

shader	
mat4buf	
delta_time	
pre_generated	,

. object.cpp, 56

:



7.12.3.4 get_animation() void Object::get_animation (vec3 rotation) [override], [virtual]

'.

out	rotation	'

Bijective.

. object.cpp, 34

7.12.3.5 get_mat4() void Object::get_mat4 (mat4 matrix) [override], [virtual]

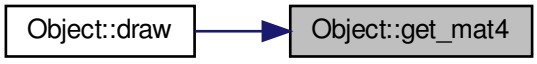
'.

out	matrix	

Bijective.

. object.cpp, 44

:



7.12.3.6 get_model() shared_ptr< Model > Object::get_model ( )

'.

'

. object.cpp, 80

7.12.3.7 get_position() void Object::get_position (vec4 position) [override], [virtual]

' .

out	position	'

Bijective.

. object.cpp, 14

7.12.3.8 get_rotation() void Object::get_rotation (vec3 rotation) [override], [virtual]

'.

out	rotation	'

Bijective.

. object.cpp, 24

7.12.3.9 get_transform() mat4 * Object::get_transform ( )

.

. object.cpp, 115

7.12.3.10 rotate() void Object::rotate (
enum coord_enum coord,
float delta_time) [override], [virtual]

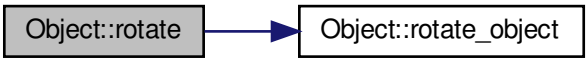
'.

in	coord	
in	delta_time	

Bijective.

. object.cpp, 65

:



7.12.3.11 rotate_all() void Object::rotate_all (
vec3 angles) [override], [virtual]

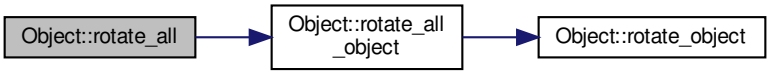
' .

in	angles	

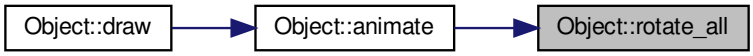
Bijective.

. object.cpp, 69

:



:



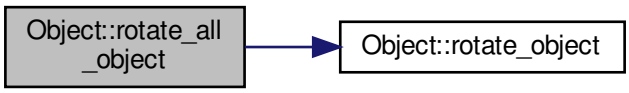
7.12.3.12 rotate_all_object() void Object::rotate_all_object (vec3 angles)

' .

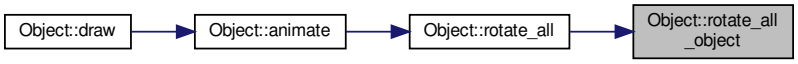
angles	(x, y, z)

. object.cpp, 99

:



:



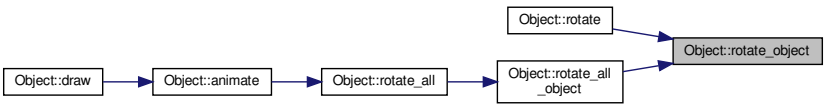
7.12.3.13 rotate_object() void Object::rotate_object (float angle, enum coord_enum coord)

' .

angle	
coord	

. object.cpp, 89

:



7.12.3.14 scale() void Object::scale (
vec3 scale)

' .

scale	(x, y, z)

. object.cpp, 111

7.12.3.15 set_animation() void Object::set_animation (
vec3 rotation) [override], [virtual]

'.

in	rotation	'.

Bijective.

. object.cpp, 39

7.12.3.16 set_position() void Object::set_position (
vec4 position) [override], [virtual]

' .

in	position	'

Bijective.

. object.cpp, 19

7.12.3.17 set_rotation() void Object::set_rotation (
vec3 rotation) [override], [virtual]

'.

in	rotation	'

Bijective.

. object.cpp, 29

7.12.3.18 translate() void Object::translate (
vec3 distances,
float delta_time) [override], [virtual]

' .

' distances, .

in	distances	
in	delta_time	

Bijective.

. object.cpp, 49

7.12.3.19 translate_object() void Object::translate_object (
vec3 distances)

' .

distances	(x, y, z)

. object.cpp, 85

7.12.4

7.12.4.1 animation vec4 Object::animation [private]

$(x, y, z, 1.0)$.

. object.h, 32

7.12.4.2 model shared_ptr<Model> Object::model [private]

'.

. object.h, 36

7.12.4.3 position vec4 Object::position [private]

'

. object.h, 28

7.12.4.4 transform mat4 Object::transform [private]

.

. object.h, 24

:

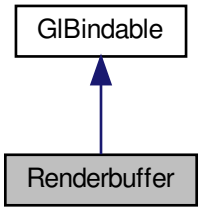
- osdo/object.h
- osdo/object.cpp

7.13 Renderbuffer

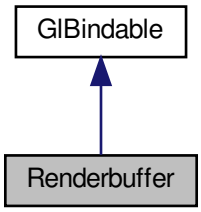
( )

#include <renderbuffer.h>

Renderbuffer



' Renderbuffer:



- Renderbuffer ()
  , .
- ~Renderbuffer () override
- void make_multisample (GLsizei size[2], GLenum target) const
  .
- void make (GLsizei size[2], GLenum target) const
  .

- GLuint _generate () const override
  .
- virtual void _bind (const GLuint id, GLenum target) const override
  , ' OpenGL .
- virtual GLenum _default () const override
  , ' .

7.13.1

( )

. renderbuffer.h, 14

7.13.2 ()

7.13.2.1 Renderbuffer() Renderbuffer::Renderbuffer ( ) [inline]

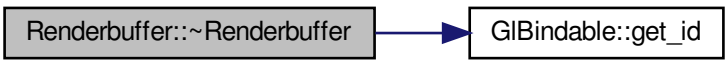
, .

. renderbuffer.h, 36

7.13.2.2 ~Renderbuffer() Renderbuffer::~Renderbuffer ( ) [override]

. renderbuffer.cpp, 21

:



7.13.3

7.13.3.1 _bind() void Renderbuffer::_bind (
const GLuint id,
GLenum target) const [override], [private], [virtual]

, ' OpenGL .

id	
target	'

GlBindable.

. renderbuffer.cpp, 11

7.13.3.2 _default() GLenum Renderbuffer::_default ( ) const [override], [private], [virtual]

, ' .

'

GlBindable.

. renderbuffer.cpp, 16

7.13.3.3 _generate() GLuint Renderbuffer::_generate ( ) const [override], [private], [virtual]

.

GlBindable.

. renderbuffer.cpp, 4

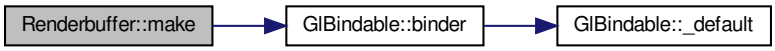
7.13.3.4 make() void Renderbuffer::make (GLsizei size[2], GLenum target) const

.

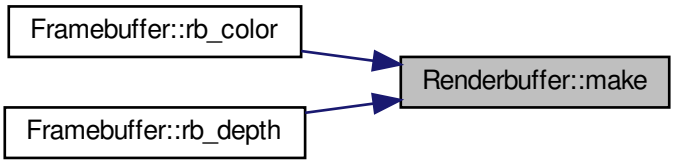
size	
target	

. renderbuffer.cpp, 31

:



:



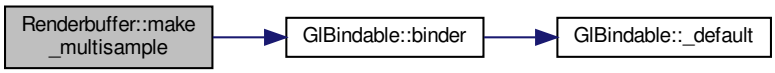
7.13.3.5 make_multisample() void Renderbuffer::make_multisample (
GLsizei size[2],
GLenum target) const

.

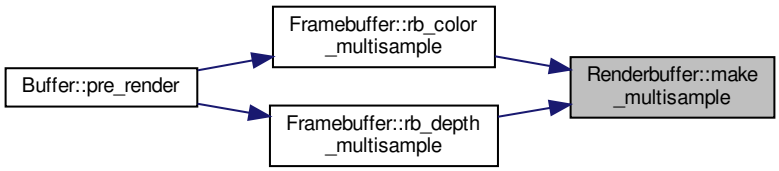
size	
target	

. renderbuffer.cpp, 25

:



:



:

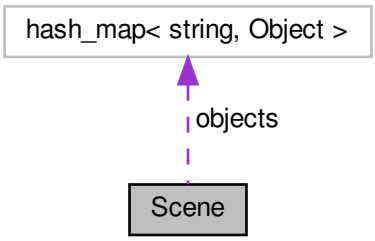
- osdo/renderbuffer.h
- osdo/renderbuffer.cpp

7.14 Scene

'.

#include <scene.h>

' Scene:



- Scene (const Context::Models &objects)
  , ' objects

- static shared_ptr< Scene > create (const Context::Models &objects)

- hash_map< string, Object > objects
  ' .

7.14.1

'.

. scene.h, 16

7.14.2 ()

7.14.2.1 Scene() Scene::Scene (
const Context::Models & objects)

, ' objects

objects	'

. scene.cpp, 7

7.14.3

7.14.3.1 create() shared_ptr< Scene > Scene::create (
const Context::Models & objects) [static]

objects	'

' .

. scene.cpp, 10

7.14.4

7.14.4.1 objects hash_map<string, Object> Scene::objects

' .

. scene.h, 20

:

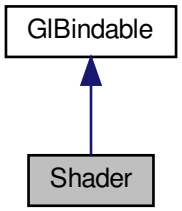
- osdo/scene.h
- osdo/scene.cpp

7.15 Shader

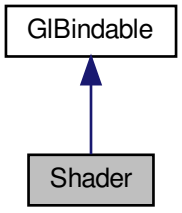
.

#include <shader.h>

Shader



' Shader:



- typedef hash_map< ShaderType, string > shader_map

.

- Shader (const GLuint shader)
- ~Shader () override
- void set_bool (const char *name, bool value)
  bool
- void set_int (const char *name, int value)
  int
- void set_float (const char *name, float value)
  float
- void set_vec2 (const char *name, vec2 value)
  vec2
- void set_vec2f (const char *name, float x, float y)
  - vec2
- void set_vec3 (const char *name, vec3 value)
  vec3
- void set_vec3f (const char *name, float x, float y, float z)
  - vec3
- void set_vec4 (const char *name, vec4 value)
  vec4
- void set_vec4f (const char *name, float x, float y, float z, float w)
  - vec4
- void set_mat2 (const char *name, mat2 mat)
  mat2
- void set_mat3 (const char *name, mat3 mat)
  mat3
- void set_mat4 (const char *name, mat4 mat)
  mat4

- static shared_ptr< Shader > create (const shader_map &shaders_paths)
  ' .

- virtual void _bind (const GLuint id, GLenum target) const override
  , ' OpenGL .

7.15.1

.

. shader.h, 31

7.15.2

7.15.2.1 shader_map typedef hash_map<ShaderType, string> Shader::shader_map

.

. shader.h, 42

7.15.3 ()

7.15.3.1 Shader() Shader::Shader (
const GLuint shader)

. shader.cpp, 118

7.15.3.2 ~Shader() Shader::~Shader ( ) [override]

. shader.cpp, 120

:

7.15.4

7.15.4.1 _bind() void Shader::_bind (
const GLuint id,
GLenum target) const [override], [private], [virtual]

, ' OpenGL .

id	OpenGL
target	, GlBindable::_bind

GlBindable.

. shader.cpp, 113

7.15.4.2 create() shared_ptr< Shader > Shader::create (const shader_map & shaders_paths) [static]

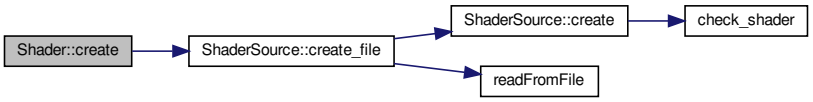
' .

shaders_paths	

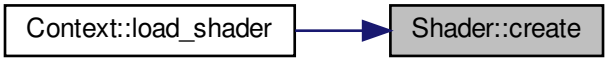
'

. shader.cpp, 124

:



:



7.15.4.3 set_bool() void Shader::set_bool (const char * name, bool value)

bool

name	'
value	

. shader.cpp, 134

:

7.15.4.4 set_float() void Shader::set_float (
const char * name,
float value)

float

name	'
value	

. shader.cpp, 142

:

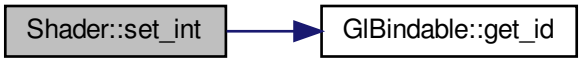
7.15.4.5 set_int() void Shader::set_int (
const char * name,
int value)

int

name	'
value	

. shader.cpp, 138

:



7.15.4.6 set_mat2() void Shader::set_mat2 (
const char * name,
mat2 mat)

mat2

name	'
mat	

. shader.cpp, 176

:

7.15.4.7 set_mat3() void Shader::set_mat3 (
const char * name,
mat3 mat)

mat3

name	'
mat	

. shader.cpp, 181

:

7.15.4.8 set_mat4() void Shader::set_mat4 (
const char * name,
mat4 mat)

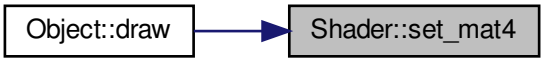
mat4

name	'
mat	

. shader.cpp, 186

:

:



7.15.4.9 set_vec2() void Shader::set_vec2 (
const char * name,
vec2 value)

vec2

name	'
value	

. shader.cpp, 146

:

7.15.4.10 set_vec2f() void Shader::set_vec2f (
const char * name,
float x,
float y)

- vec2

name	'
x	-
y	-

. shader.cpp, 151

:

7.15.4.11 set_vec3() void Shader::set_vec3 (
const char * name,
vec3 value)

vec3

name	'
value	

. shader.cpp, 156

:

7.15.4.12 set_vec3f() void Shader::set_vec3f (
const char * name,
float x,
float y,
float z)

- vec3

name	'
x	-
y	-
z	-

. shader.cpp, 161

:

7.15.4.13 set_vec4() void Shader::set_vec4 (
const char * name,
vec4 value)

vec4

name	'
value	

. shader.cpp, 166

:

7.15.4.14 set_vec4f() void Shader::set_vec4f (
const char * name,
float x,
float y,
float z,
float w)

- vec4

name	'
x	-
y	-
z	-
w	-

. shader.cpp, 171

:

:

- osdo/shader.h
- osdo/shader.cpp

7.16 ShaderSource

- ShaderSource (const GLuint id)
- GLuint get_id ()
- void attach (const GLuint program)

- static shared_ptr< ShaderSource > create (GLenum type, const char *code)
- static shared_ptr< ShaderSource > create_file (GLenum type, const string &path)

- const GLuint id

7.16.1

. shader.cpp, 70

7.16.2 ()

7.16.2.1 ShaderSource() ShaderSource::ShaderSource (
const GLuint id) [inline]

. shader.cpp, 73

7.16.3

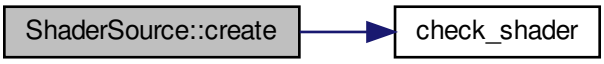
7.16.3.1 attach() void ShaderSource::attach (
const GLuint program) [inline]

. shader.cpp, 90

7.16.3.2 create() static shared_ptr<ShaderSource> ShaderSource::create (
GLenum type,
const char * code) [inline], [static]

. shader.cpp, 74

:

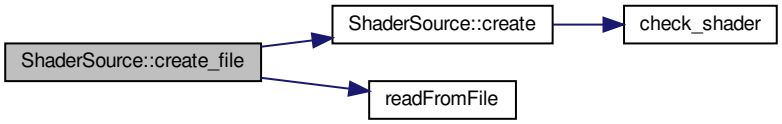


:

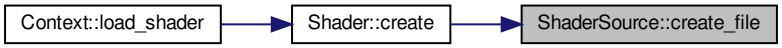
7.16.3.3 create_file() static shared_ptr<ShaderSource> ShaderSource::create_file (GLenum type, const string & path) [inline], [static]

. shader.cpp, 83

:



:



7.16.3.4 get_id() GLuint ShaderSource::get_id ( ) [inline]

. shader.cpp, 89

7.16.4

7.16.4.1 id const GLuint ShaderSource::id [private]

. shader.cpp, 71

:

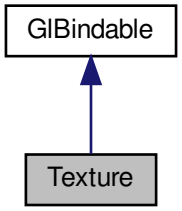
- osdo/shader.cpp

7.17 Texture

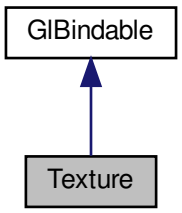
, .

#include <texture.h>

Texture



' Texture:



- Texture ()
- ~Texture () override
- void update (const Image &image) const

  .
- void make_2d_multisample (GLsizei size[2]) const

  .
- void make_2d (GLsizei size[2]) const

  .

- GLuint _generate () const override
  .
- virtual void _bind (const GLuint id, GLenum target) const override
  , ' OpenGL .
- virtual GLenum _default () const override
  , ' .

7.17.1

, .

. texture.h, 16

7.17.2 ()

7.17.2.1 Texture() Texture::Texture ( ) [inline]

. texture.h, 35

7.17.2.2 ~Texture() Texture::~Texture ( ) [override]

. texture.cpp, 22

:

7.17.3

7.17.3.1 _bind() void Texture::_bind (
const GLuint id,
GLenum target) const [override], [private], [virtual]

, ' OpenGL .

id	
target	'

GlBindable.

. texture.cpp, 12

7.17.3.2 _default() GLenum Texture::_default ( ) const [override], [private], [virtual]

, ' .

'

GlBindable.

. texture.cpp, 17

7.17.3.3 _generate() GLuint Texture::_generate ( ) const [override], [private], [virtual]

.

GlBindable.

. texture.cpp, 5

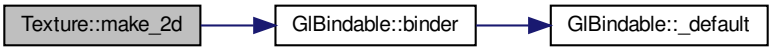
7.17.3.4 make_2d() void Texture::make_2d (
GLsizei size[2]) const

.

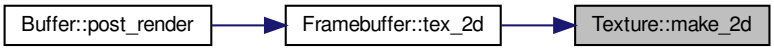
size	

. texture.cpp, 53

:



:



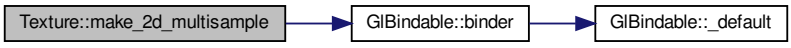
7.17.3.5 make_2d_multisample() void Texture::make_2d_multisample (GLsizei size[2]) const

.

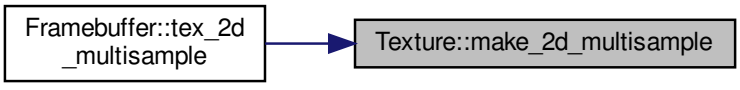
size	

. texture.cpp, 47

:



:



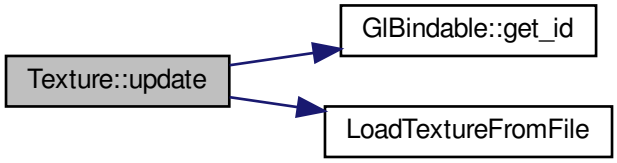
7.17.3.6 update() void Texture::update (const Image & image) const

.

image	

. texture.cpp, 43

:



:

- osdo/texture.h
- osdo/texture.cpp

7.18 OSDO::vector< T >

.

#include <easyvector.h>

- vector (size_t size=0)
- vector (vector &&vector)
- vector (const vector &vector)
- ~vector ()
- vector & operator= (vector &&vector)
- vector & operator= (const vector &vector)
- T & operator[] (size_t i)
- size_t size () const
- T * data ()
- const T * data () const
- void clear ()

- void _allocate (size_t size)
  size
- void _free ()
  ' .
- void _copy (const vector &vector)
  .
- void _move (vector &vector)
  .

- T * arr
  T
- size_t _size
  .

7.18.1

template<class T>
class OSDO::vector< T >

.

. easyvector.h, 19

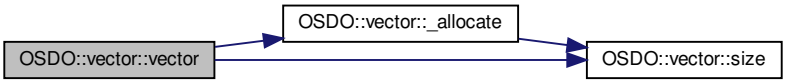
7.18.2 ()

7.18.2.1 vector() [1/3] template<class T >
OSDO::vector< T >::vector (
size_t size = 0) [inline]

size	

. easyvector.h, 71

:



:

7.18.2.2 vector() [2/3] template<class T >

OSDO::vector< T >::vector (
vector< T > && vector) [inline]

vector	

. easyvector.h, 78

:

7.18.2.3 vector() [3/3] template<class T >

OSDO::vector< T >::vector (
const vector< T > & vector) [inline]

vector	

. easyvector.h, 85

:

7.18.2.4 ~vector() template<class T >
OSDO::vector< T >::~vector ( ) [inline]

. easyvector.h, 88

:

7.18.3

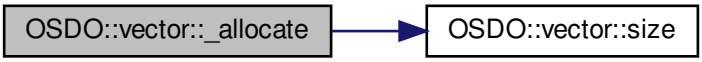
7.18.3.1 _allocate() template<class T >
void OSDO::vector< T >::_allocate (
size_t size) [inline], [private]

size

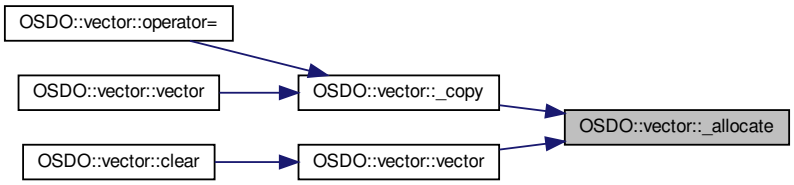
size	

. easyvector.h, 32

:



:



7.18.3.2 _copy() template<class T >

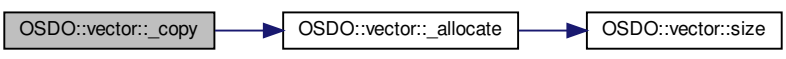
void OSDO::vector< T >::_copy (
const vector< T > & vector) [inline], [private]

.

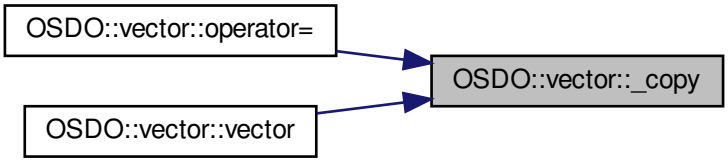
vector	

. easyvector.h, 53

:



:

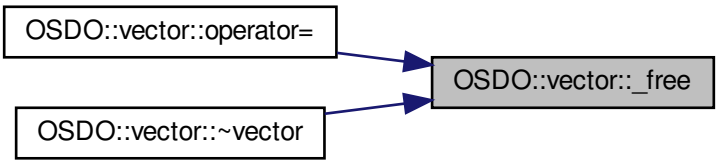


7.18.3.3 _free() template<class T >
void OSDO::vector< T >::_free ( ) [inline], [private]

' .

. easyvector.h, 43

:



7.18.3.4 _move() template<class T >
void OSDO::vector< T >::_move (
vector< T > & vector) [inline], [private]

.

vector	

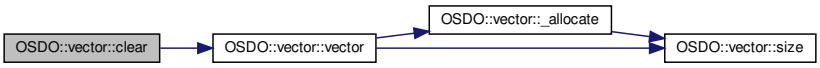
. easyvector.h, 62

7.18.3.5 clear() template<class T >

void OSDO::vector< T >::clear ( ) [inline]

. easyvector.h, 111

:



7.18.3.6 data() [1/2] template<class T >

T* OSDO::vector< T >::data ( ) [inline]

. easyvector.h, 105

7.18.3.7 data() [2/2] template<class T >

const T* OSDO::vector< T >::data ( ) const [inline]

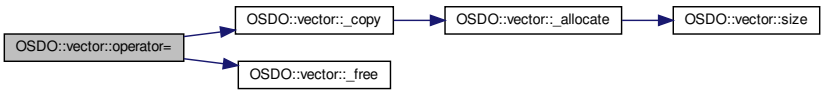
. easyvector.h, 108

7.18.3.8 operator=() [1/2] template<class T >

vector& OSDO::vector< T >::operator= (
const vector< T > & vector) [inline]

. easyvector.h, 94

:

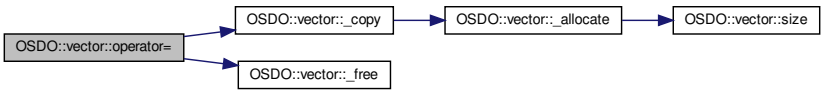


7.18.3.9 operator=() [2/2] template<class T >

vector& OSDO::vector< T >::operator= (
vector< T > && vector) [inline]

. easyvector.h, 89

:



7.18.3.10 operator[]() template<class T >

T& OSDO::vector< T >::operator[] (
size_t i) [inline]

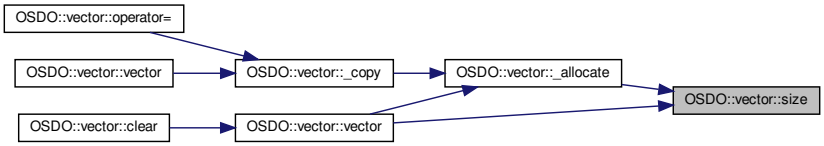
. easyvector.h, 99

7.18.3.11 size() template<class T >

size_t OSDO::vector< T >::size ( ) const [inline]

. easyvector.h, 102

:



7.18.4

7.18.4.1 _size template<class T >

size_t OSDO::vector< T >::_size [private]

.

. easyvector.h, 27

7.18.4.2 arr template<class T >
T* OSDO::vector< T >::arr [private]

T

. easyvector.h, 23

:

- osdo/easyvector.h

7.19 Vertex

, .

#include <vertex.h>

- vec4 position
  .
- vec3 normal
  .
- unsigned char color [4]
  .
- vec2 uv
  .

7.19.1

, .

. vertex.h, 12

7.19.2

7.19.2.1 color unsigned char Vertex::color[4]

.

. vertex.h, 24

7.19.2.2 normal vec3 Vertex::normal

.

. vertex.h, 20

7.19.2.3 position vec4 Vertex::position

.

. vertex.h, 16

7.19.2.4 uv vec2 Vertex::uv

.

. vertex.h, 28

:

- osdo/vertex.h

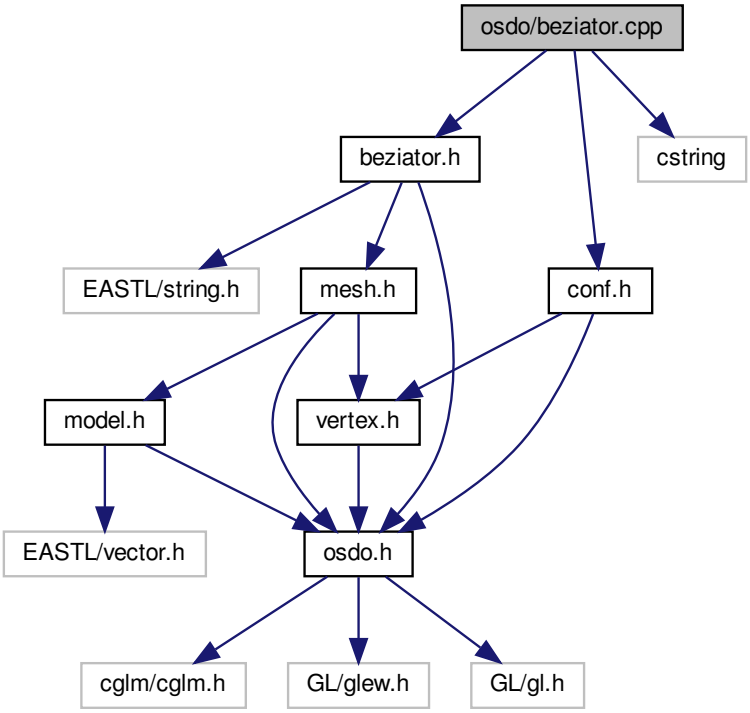
8

8.1 LICENSE.md

8.2 osdo/beziator.cpp

```
#include "beziator.h"
#include "conf.h"
```

#include <cstring>
beziator.cpp:



- #define BEZIER_TANGENT_INIT
- #define ucast static_cast<unsigned>

- typedef Vertex * surface_t[4][4]

- void bezier_curve (float a, mat4 points, vec4 dest)
- void bezier_curve_tangent (float a, mat4 points, vec4 dest)
- void bezier_surface (float u, float v, surface_t points, vec4 dest, vec4 normal)

8.2.1

8.2.1.1 BEZIER_TANGENT_INIT #define BEZIER_TANGENT_INIT

:
```
{\
{  0,  0,  0,  0},\
{ -3,  9, -9,  3},\
{  6,-12,  6,  0},\
{ -3,  3,  0,  0},}
```

. beziator.cpp, 5

8.2.1.2 ucast #define ucast static_cast<unsigned>

. beziator.cpp, 11

8.2.2

8.2.2.1 surface_t typedef Vertex* surface_t[4][4]

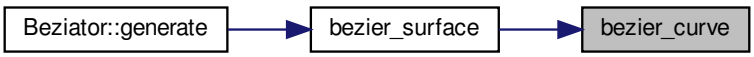
. beziator.cpp, 16

8.2.3

8.2.3.1 bezier_curve() void bezier_curve (
float a,
mat4 points,
vec4 dest)

. beziator.cpp, 71

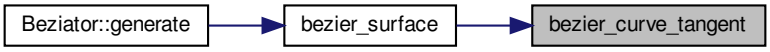
:



8.2.3.2 bezier_curve_tangent() void bezier_curve_tangent (
float a,
mat4 points,
vec4 dest)

. beziator.cpp, 78

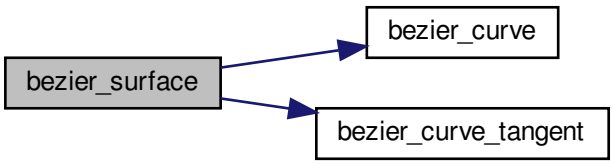
:



8.2.3.3 bezier_surface() void bezier_surface (
float u,
float v,
surface_t points,
vec4 dest,
vec4 normal)

. beziator.cpp, 85

:



:

8.3 beziator.cpp

```
00001 #include "beziator.h"
00002 #include "conf.h"
00003 #include <cstring>
00004
00005 #define BEZIER_TANGENT_INIT {\
00006 {  0,  0,  0,  0},\
00007 { -3,  9, -9,  3},\
00008 {  6,-12,  6,  0},\
00009 { -3,  3,  0,  0},}
00010
00011 #define ucast static_cast<unsigned>
00012
00013 static mat4 BEZIER = GLM_BEZIER_MAT_INIT;
00014 static mat4 BEZIER_TANGENT = BEZIER_TANGENT_INIT;
00015
00016 typedef Vertex *surface_t[4][4];
00017
00018 Beziator::Beziator(const string& path) : path(path) {}
00019
00020 bool Beziator::init() {
00021     printf("%s\n", path.c_str());
00022     FILE *file = fopen(path.c_str(), "r");
00023     if (file == nullptr) {
00024         return false;
00025     }
00026
00027     size_t points_size, surfaces_size;
00028     fscanf(file, "%lu%lu", &points_size, &surfaces_size);
00029     vector<Vertex> &points = vertices;
00030     points.resize(points_size);
00031     indices.resize(surfaces_size * 16);
00032     surfacei_t *surfaces = reinterpret_cast<surfacei_t*>(indices.data());
00033
00034     points_size = points.size();
00035     unsigned char color[4] = {0, 255, 0, 255};
00036     surfaces_size = indices.size() / 16;
00037     for (size_t i = 0; i < points_size; i++) {
00038         vec4 init = GLM_VEC4_BLACK_INIT;
00039         vec4 &point = points[i].position;
00040         glm_vec4_copy(init, point);
00041         fscanf(file, "%f%f%f", point, point + 1, point + 2);
00042         memcpy(points[i].color, color, 4);
00043         memcpy(points[i].normal, point, 3 * sizeof(float));
00044     }
00045     int j, k;
00046     for (size_t i = 0; i < surfaces_size; i++) {
00047         for (j = 0; j < 4; j++)
00048             for (k = 0; k < 4; k++) {
00049                 fscanf(file, "%u", surfaces[i][j] + k);
00050             }
00051     }
00052     fclose(file);
00053
00054     update(points.data(), points.size(), indices.data(), indices.size());
00055     return true;
00056 }
00057
00058 Beziator::~Beziator() {
00059 }
00060
00061 void Beziator::draw(Shader &shader, bool pre_generated) {
00062     if (pre_generated) {
00063         this->mesh.draw_mode(GL_TRIANGLES);
00064     } else {
00065         glPatchParameteri(GL_PATCH_VERTICES, 16);
00066         Mesh::draw_mode(GL_PATCHES);
00067     }
00068 }
00069
00070
00071 void bezier_curve(float a, mat4 points, vec4 dest) {
00072     mat4 matrix;
00073     glm_vec4_cubic(a, dest);
00074     glm_mat4_mul(points, BEZIER, matrix);
00075     glm_mat4_mulv(matrix, dest, dest);
00076 }
00077
00078 void bezier_curve_tangent(float a, mat4 points, vec4 dest) {
00079     mat4 matrix;
00080     glm_vec4_cubic(a, dest);
00081     glm_mat4_mul(points, BEZIER_TANGENT, matrix);
00082     glm_mat4_mulv(matrix, dest, dest);
00083 }
00084
00085 void bezier_surface(
```

```
00086         float u, float v, surface_t points, vec4 dest, vec4 normal) {
00087     mat4 m, res1, res2, res3;
00088
00089     for (int i = 0; i < 4; i++) {
00090         glm_vec4_copy(points[0][i]->position, m[0]);
00091         glm_vec4_copy(points[1][i]->position, m[1]);
00092         glm_vec4_copy(points[2][i]->position, m[2]);
00093         glm_vec4_copy(points[3][i]->position, m[3]);
00094         bezier_curve(u, m, res1[i]);
00095
00096         glm_vec4_copy(points[i][0]->position, m[0]);
00097         glm_vec4_copy(points[i][1]->position, m[1]);
00098         glm_vec4_copy(points[i][2]->position, m[2]);
00099         glm_vec4_copy(points[i][3]->position, m[3]);
00100         bezier_curve(v, m, res2[i]);
00101     }
00102
00103     bezier_curve(v, res1, dest);
00104     bezier_curve_tangent(v, res1, res3[1]);
00105     bezier_curve_tangent(u, res2, res3[3]);
00106
00107     glm_cross(res3[1], res3[3], normal);
00108 }
00109
00110 bool Beziator::save() {
00111     FILE *file = fopen(this->path.c_str(), "w");
00112     if (file == nullptr) {
00113         printf("ERROR: failed to open file %s\n", this->path.c_str());
00114         return false;
00115     }
00116     size_t surfaces_size = this->indices.size() / 16;
00117     surfacei_t *surfaces = reinterpret_cast<surfacei_t*>(indices.data());
00118     fprintf(file, "%lu %lu\n", this->vertices.size(), this->indices.size() / 16);
00119     for (size_t i = 0; i < this->vertices.size(); i++) {
00120         vec4 &point = this->vertices[i].position;
00121         fprintf(file, "%f %f %f\n", static_cast<double>(point[0]),
00122                 static_cast<double>(point[1]), static_cast<double>(point[2]));
00123     }
00124     int j, k;
00125     for (size_t i = 0; i < surfaces_size; i++) {
00126         for (j = 0; j < 4; j++)
00127             for (k = 0; k < 4; k++) {
00128                 fprintf(file, "%u ", surfaces[i][j][k]);
00129             }
00130         fprintf(file, "\n");
00131     }
00132     fclose(file);
00133     return true;
00134 }
00135
00136 void Beziator::generate(size_t d) {
00137     static const int controls_lines[][2] = {
00138         {0, 0}, {0, 1}, {0, 0}, {1, 1}, {0, 0}, {1, 0},
00139         {0, 3}, {0, 2}, {0, 3}, {1, 2}, {0, 3}, {1, 3},
00140         {3, 0}, {2, 0}, {3, 0}, {2, 1}, {3, 0}, {3, 1},
00141         {3, 3}, {3, 2}, {3, 3}, {2, 2}, {3, 3}, {2, 3},
00142     };
00143     static const int ctrls_size = sizeof(controls_lines) / sizeof(int[2]);
00144     /* // Old variant of config, I leave it for several commits
00145     static const uint8_t ALL_SQUARE_LINES[][4] = {
00146         {1, 0, 0, 0}, {0, 0, 0, 1}, {0, 1, 1, 1}, {1, 1, 1, 0},
00147         {1, 1, 0, 0}, {0, 0, 1, 1}, {1, 0, 0, 1}, {0, 1, 1, 0}
00148     };*/
00149     static const uint8_t SQUARE_TYPES[][10][2] = {
00150         {{0, 0}, {0, 1}, {1, 1}, {0, 0}, {8, 8},
00151          {1, 1}, {1, 0}, {0, 0}, {1, 1}, {9, 9}},
00152         {{0, 0}, {0, 1}, {1, 1}, {1, 0}, {0, 0}, {9, 9}},
00153         {{1, 0}, {0, 0}, {0, 1}, {1, 0}, {8, 8},
00154          {0, 1}, {1, 1}, {1, 0}, {0, 1}, {9, 9}},
00155         /* // And again old variant of config
00156         {1, 2, 4, 1, 8, 0, 5, 3, 0, 9},
00157         {0, 1, 2, 3, 0, 9},
00158         {0, 1, 5, 0, 8, 2, 3, 5, 2, 9},*/
00159     };
00160     static const uint8_t BEZIER_SQUARE_TYPES[3][3] = {
00161         {0, 1, 2}, {1, 1, 1}, {2, 1, 0}
00162     };
00163
00164     size_t j, k, index;
00165     float x, u, v;
00166     vec4 *point, vertex, normal;
00167     surface_t surface;
00168     GLuint verts = 0, verts2 = 0;
00169     //verts3 = 0;
00170     const int *c;
00171     mat4 m4b;
00172     uint8_t si, sj;
```

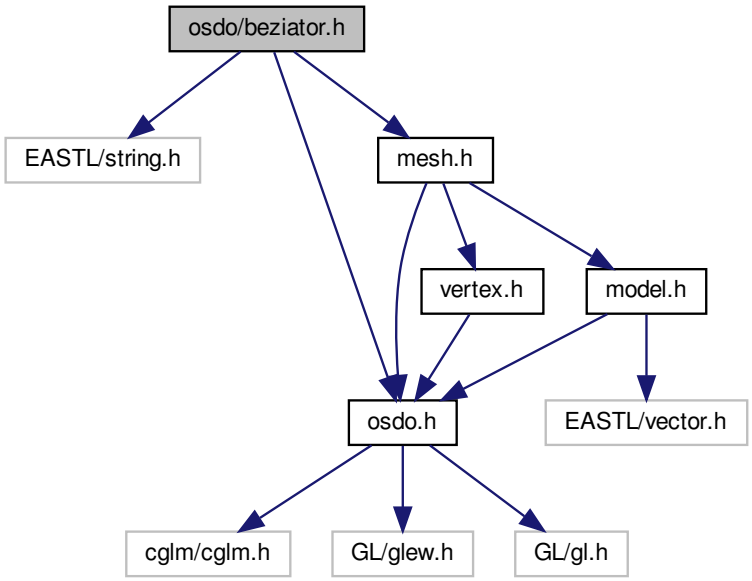
```
00173     const uint8_t (*st)[2];
00174
00175     Mesh *mesh = &this->mesh;
00176     // Mesh *mesh_skel = &this->frame;
00177     // Mesh *mesh_normals = &this->normals;
00178     x = 1.f / (d - 1);
00179
00180     const size_t surfaces_size = this->indices.size() / 16;
00181     surfacei_t *surfaces = reinterpret_cast<surfacei_t*>(indices.data());
00182     const size_t size = 6 * 9 * d * d * surfaces_size;
00183     //const GLsizei sizei = static_cast<GLsizei>(size);
00184     vector<Vertex> V(size);
00185     vector<GLuint> E(size);
00186     /*vector<Vertex> V2(size);
00187     vector<GLuint> E2(size);
00188     vector<Vertex> V3(this->vertices.size());
00189     vector<GLuint> E3(this->vertices.size() * 4);*/
00190
00191     // Creator frame vertices
00192     /*for (size_t i = 0; i < this->vertices.size(); i++) {
00193         point = &this->vertices[i].position;
00194         glm_vec3_copy(*point, V2[i].position);
00195         V2[i].color[1] = 255;
00196         V2[i].color[3] = 255;
00197     }*/
00198
00199     for (size_t i = 0; i < surfaces_size; i++) {
00200         for (j = 0; j < 4; j++) {
00201             for (k = 0; k < 4; k++) {
00202                 surface[j][k] = &(this->vertices[surfaces[i][j][k]]);
00203             }
00204         }
00205         // Creator frame lines
00206         for (j = 0; j < ctrls_size; j++) {
00207             c = controls_lines[j];
00208             //E2[verts2++] = ucast(surfaces[i][c[0]][c[1]]);
00209         }
00210
00211         // Create vertices
00212         for (j = 0; j < d; j++) {
00213             for (k = 0; k < d; k++) {
00214                 u = static_cast<float>(j)*x; v = static_cast<float>(k)*x;
00215                 index = i * d * d + j * d + k;
00216                 bezier_surface(u, v, surface, vertex, normal);
00217                 glm_normalize(normal);
00218                 glm_vec3_copy(vertex, V[index].position);
00219                 glm_vec3_copy(normal, V[index].normal);
00220                 V[index].color[0] = 0;
00221                 V[index].color[1] = 255;
00222                 V[index].color[2] = 0;
00223                 /*glm_vec3_copy(vertex, V3[verts3].position);
00224                 E3[verts3] = verts3;
00225                 verts3++;
00226                 glm_vec3_add(normal, vertex, V3[verts3].position);
00227                 E3[verts3] = verts3;
00228                 verts3++;*/
00229             }
00230         }
00231
00232         // Create triangles
00233         for (j = 0; j < d - 1; j++)
00234             for (k = 0; k < d - 1; k++) {
00235                 E[verts++] = ucast(i * d * d + (j + 1) * d + k);
00236                 E[verts++] = ucast(i * d * d + j * d + k);
00237                 E[verts++] = ucast(i * d * d + j * d + k + 1);
00238
00239                 E[verts++] = ucast(i * d * d + j * d + k + 1);
00240                 E[verts++] = ucast(i * d * d + (j + 1) * d + k + 1);
00241                 E[verts++] = ucast(i * d * d + (j + 1) * d + k);
00242             }
00243
00244         for (si = 0; si < 3; si++) {
00245             for (sj = 0; sj < 3; sj++) {
00246                 st = SQUARE_TYPES[BEZIER_SQUARE_TYPES[si][sj]];
00247                 while (st[2][0] != 9) {
00248                     if (st[2][0] == 8) {
00249                         st += 3;
00250                     }
00251                     index = static_cast<size_t>((surface)[si+st[1][0]][sj+st[1][1]] - this->vertices.data());
00252                     glm_vec3_sub(((surface)[si+st[1][0]][sj+st[1][1]])->position,
00253                             ((surface)[si+st[0][0]][sj+st[0][1]])->position, m4b[0]);
00254                     glm_vec3_sub(((surface)[si+st[1][0]][sj+st[1][1]])->position,
00255                             (surface[si+st[2][0]][sj+st[2][1]])->position, m4b[1]);
00256                     glm_vec3_cross(m4b[0], m4b[1], m4b[2]);
00257                     //glm_vec3_add(V2[index].normal, m4b[2], V2[index].normal);
00258                     st++;
00259                 }
```

```
00260             }
00261         }
00262     }
00263     /*
00264     // Example drawing of normals for frame
00265     for (size_t i = 0; i < this->points_size; i++) {
00266         glm_normalize(V2[i].normal);
00267         glm_vec3_add(V2[i].position, V2[i].normal,
00268                      V2[i+this->points_size].position);
00269         E2[verts2++] = (unsigned)i;
00270         E2[verts2++] = (unsigned)(i+this->points_size);
00271     }*/
00272     mesh->update(V.data(), V.size(), E.data(), E.size());
00273     //mesh_skel->update(V2, E2);
00274     //mesh_update(mesh_normals, sizei, sizei, V3, E3);
00275 }
00276
00277 void Beziator::rotate(size_t i) {
00278     surfacei_t s;
00279     surfacei_t *surfaces = reinterpret_cast<surfacei_t*>(indices.data());
00280     memcpy(s, surfaces[i], sizeof(surfacei_t));
00281     for (int k = 0; k < 4; k++)
00282         for (int j = 0; j < 4; j++) {
00283             surfaces[i][k][j] = s[j][k];
00284         }
00285 }
00286
00287 vector<Vertex> *Beziator::get_vertices() {
00288     return &vertices;
00289 }
```

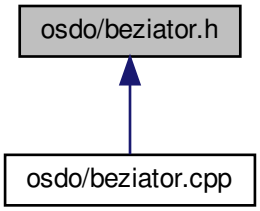
8.4 osdo/beziator.h

.

#include <EASTL/string.h>
#include "osdo.h"
#include "mesh.h"
beziator.h:



, :



- class Beziator
  .

- typedef GLuint surfacei_t[4][4]
  , 4x4.

8.4.1

.

. beziator.h

8.4.2

8.4.2.1 surfacei_t typedef GLuint surfacei_t[4][4]

, 4x4.

. beziator.h, 17

8.5 beziator.h

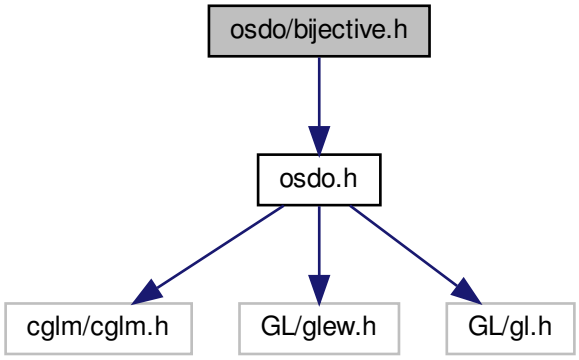
```
00001 /**
00002  * @file beziator.h
00003  * @brief           .
00004  */
00005 #ifndef BEZIATOR_H
00006 #define BEZIATOR_H
00007
00008 #include <EASTL/string.h>
00009 #include "osdo.h"
00010 #include "mesh.h"
00011
00012 using eastl::string;
00013
00014 /**
00015  * @brief    ,    4x4.
00016  */
00017 typedef GLuint surfacei_t[4][4];
00018
00019 /**
00020  * @brief           .
00021  */
00022 class Beziator : public Mesh {
00023 public:
00024     /**
00025      * @brief        .
00026      */
00027     typedef surfacei_t* surfaces_vector;
00028 protected:
00029     /**
00030      * @brief       .
00031      */
00032     const string path;
00033     /**
00034      * @brief    CPU  .
00035      */
00036     Mesh mesh;
00037     //Mesh frame;
00038     //Mesh normals;
00039     /**
00040      * @brief  / .
00041      */
00042     vector<Vertex> vertices;
00043     /**
00044      * @brief  ,    .
00045      *
00046      *      16 ,
00047      *    4x4.
00048      *     'surfaces_vector':
00049      *
00050      *     surfacei_t *surfaces = reinterpret_cast<surfacei_t*>(indices.data());
00051      */
00052     vector<GLuint> indices;
00053 public:
00054     /**
00055      * @brief   Beziator,       .
00056      *
00057      * '    'Beziator::init'
00058      *    '.
00059      * @param path       .
00060      */
00061     Beziator(const string& path);
00062     ~Beziator() override;
00063
00064     /**
00065      * @brief    '.
00066      * @return ,     .
00067      */
00068     bool init();
00069
00070     /**
00071      * @brief  .
00072      *
00073      *    'pre_generated'
00074      * ,   'false',
00075      *   4x4,    'true',
00076      *      .
00077      * @param shader      .
00078      * @param pre_generated ,      .
00079      */
00080     void draw(Shader &shader, bool pre_generated) override;
00081
00082     /**
00083      * @brief    .
00084      *
00085      *   'd'
```

```
00086      * ,    8,
00087      * 8x8=64 .
00088      * @param d   .
00089      */
00090     void generate(size_t d = 8) override;
00091
00092     /**
00093      * @brief    ,    'path'.
00094      * @return   .
00095      */
00096     bool save();
00097
00098     /**
00099      * @brief    ,      .
00100      * @param i   .
00101      */
00102     void rotate(size_t i);
00103
00104     /**
00105      * @brief    .
00106      * @return    'vertices'.
00107      */
00108     vector<Vertex> *get_vertices() override;
00109 };
00110
00111 #endif // BEZIATOR_H
```

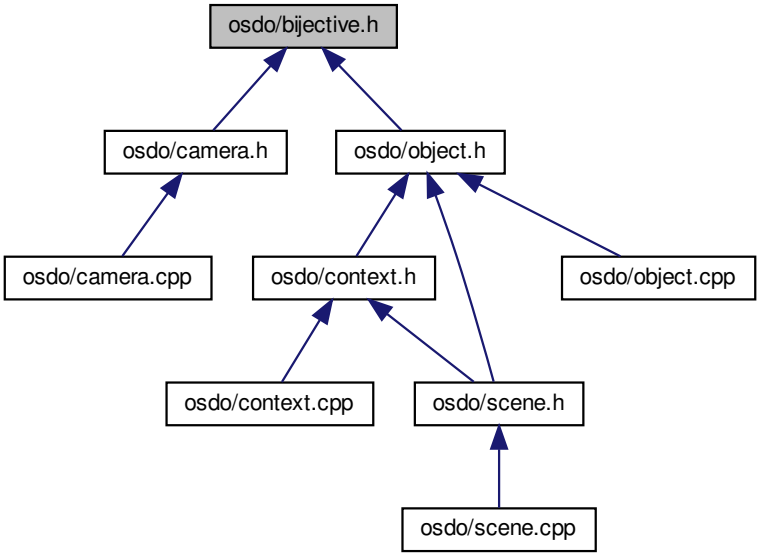
8.6 osdo/bijective.h

', .

#include "osdo.h"
bijective.h:



, :



- class Bijective
  '; .

8.6.1

'; .

. bijective.h

8.7 bijective.h

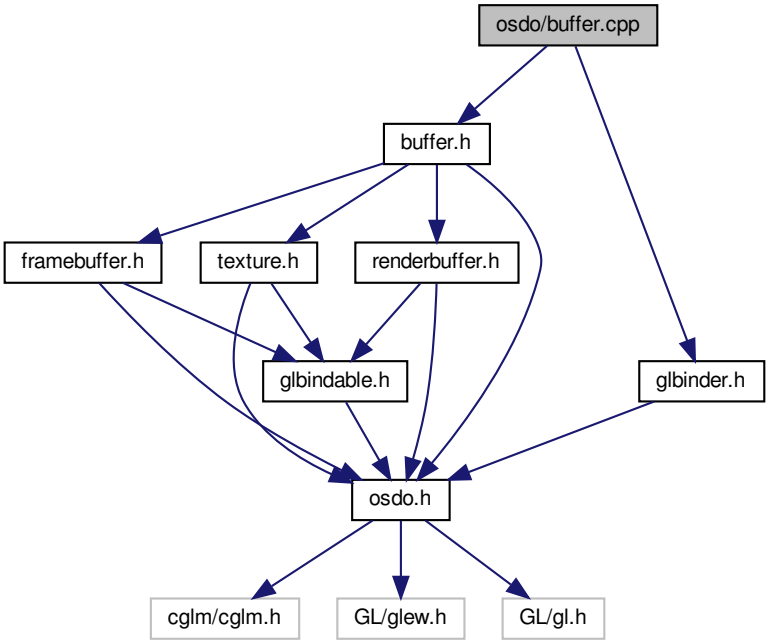
```
00001 /**
00002  * @file bijective.h
00003  * @brief  ',  .
00004  */
00005 #ifndef BIJECTIVE_H
00006 #define BIJECTIVE_H
00007
00008 #include "osdo.h"
00009
00010 /**
00011  * @brief  ',  .
00012  */
00013 class Bijective {
00014 public:
00015     virtual ~Bijective() {}
00016
00017     /**
00018      * @brief  ' .
00019      * @param[out] position  '
00020      */
00021     virtual void get_position(vec4 position) {}
00022     /**
```

```
00023     * @brief    ' .
00024     * @param[in] position   '
00025     */
00026    virtual void set_position(vec4 position) {}
00027
00028    /**
00029     * @brief    '.
00030     * @param[out] rotation    '
00031     */
00032    virtual void get_rotation(vec3 rotation) {}
00033    /**
00034     * @brief    '.
00035     * @param[in] rotation   '
00036     */
00037    virtual void set_rotation(vec3 rotation) {}
00038
00039    /**
00040     * @brief     '.
00041     * @param[out] rotation    '
00042     */
00043    virtual void get_animation(vec3 rotation) {}
00044    /**
00045     * @brief     '.
00046     * @param[in] rotation    '.
00047     */
00048    virtual void set_animation(vec3 rotation) {}
00049
00050    /**
00051     * @brief      '.
00052     * @param[out] matrix
00053     */
00054    virtual void get_mat4(mat4 matrix) {}
00055
00056    /**
00057     * @brief  '  .
00058     *
00059     *  '       'distances',
00060     *        .
00061     * @param[in] distances
00062     * @param[in] delta_time
00063     */
00064    virtual void translate(vec3 distances, float delta_time) {}
00065    /**
00066     * @brief  '.
00067     * @param[in] coord
00068     * @param[in] delta_time
00069     */
00070    virtual void rotate(enum coord_enum coord, float delta_time) {}
00071    /**
00072     * @brief  '    .
00073     * @param[in] angles
00074     */
00075    virtual void rotate_all(vec3 angles) {}
00076    /**
00077     * @brief     '.
00078     * @param[in] angles
00079     * @param[in] delta_time
00080     */
00081    virtual void add_animation(vec3 angles, float delta_time) {}
00082 };
00083
00084 #endif // BIJECTIVE_H
```

8.8 osdo/buffer.cpp

```
#include "buffer.h"
#include "glbinder.h"
```

buffer.cpp:



8.9 buffer.cpp

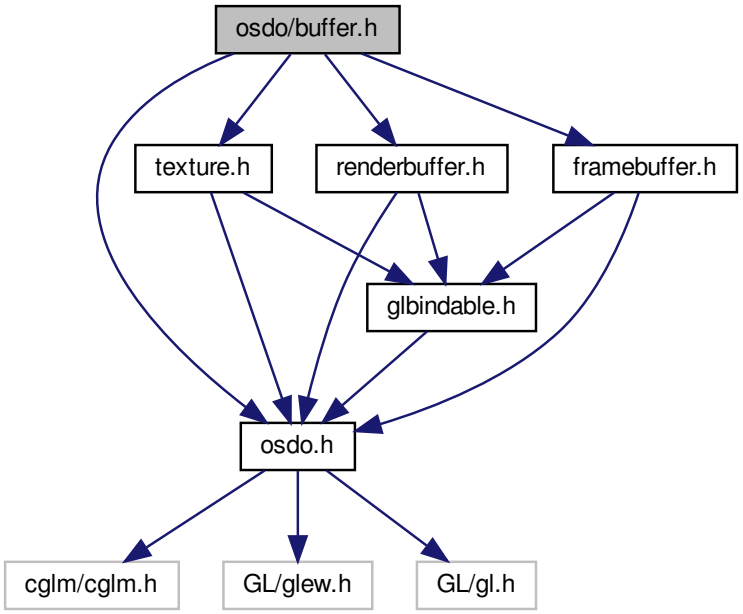
```
00001 #include "buffer.h"
00002 #include "glbinder.h"
00003
00004 //static GLenum DRAW_BUFFERS[] = {GL_COLOR_ATTACHMENT0};
00005
00006 bool Buffer::pre_render(GLsizei size[2]) {
00007     this->ms_fb.bind();
00008
00009     this->ms_fb.rb_color_multisample(size, this->color_rb);
00010     this->ms_fb.rb_depth_multisample(size, this->depth_rb);
00011
00012     if (!this->ms_fb.check()) {
00013         return false;
00014     }
00015
00016     glEnable(GL_DEPTH_TEST);
00017     glViewport(0, 0, size[0], size[1]);
00018     return true;
00019 }
00020
00021 void Buffer::post_render(GLsizei size[2]) {
00022     this->ms_fb.unbind();
00023
00024     {
00025         GlBinder b = this->fb.binder();
00026         this->fb.tex_2d(size, this->tex);
00027     }
00028     GlBinder b1 = this->ms_fb.binder(GL_READ_FRAMEBUFFER),
00029             b2 = this->fb.binder(GL_DRAW_FRAMEBUFFER);
00030
00031     glBlitFramebuffer(0, 0, size[0], size[1], 0, 0, size[0], size[1],
00032             GL_COLOR_BUFFER_BIT, GL_NEAREST);
00033 }
00034
00035 const Texture &Buffer::get_tex() {return tex;}
```

8.10 osdo/buffer.h

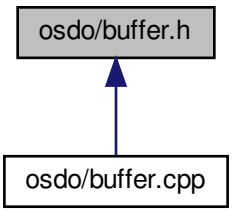
, .

```
#include "osdo.h"
#include "texture.h"
#include "renderbuffer.h"
#include "framebuffer.h"
```

buffer.h:



, :



- class Buffer

, .

8.10.1

, .

. buffer.h

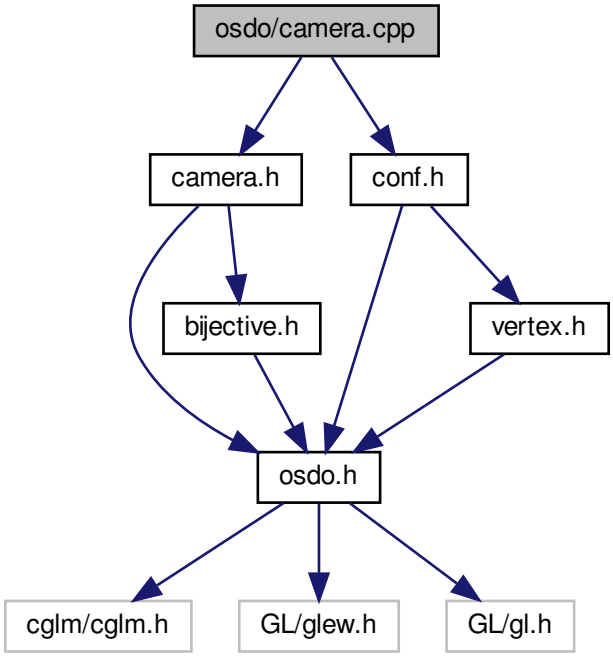
8.11 buffer.h

```
00001 /**
00002  * @file buffer.h
00003  * @brief ,      .
00004  */
00005 #ifndef BUFFER_H
00006 #define BUFFER_H
00007
00008 #include "osdo.h"
00009 #include "texture.h"
00010 #include "renderbuffer.h"
00011 #include "framebuffer.h"
00012
00013 /**
00014  * @brief ,      .
00015  */
00016 class Buffer {
00017     /**
00018      * @brief     .
00019      */
00020     Texture tex;
00021     /**
00022      * @brief    .
00023      */
00024     Renderbuffer color_rb;
00025     /**
00026      * @brief    .
00027      */
00028     Renderbuffer depth_rb;
00029     /**
00030      * @brief      .
00031      */
00032     Framebuffer ms_fb;
00033     /**
00034      * @brief    .
00035      */
00036     Framebuffer fb;
00037 public:
00038     /**
00039      * @brief   .
00040      * @param[in] size    .
00041      * @return      .
00042      */
00043     bool pre_render(GLsizei size[2]);
00044     /**
00045      * @brief     .
00046      * @param[in] size    .
00047      */
00048     void post_render(GLsizei size[2]);
00049
00050     /**
00051      * @brief      .
00052      * @return
00053      */
00054     const Texture& get_tex();
00055 };
00056
00057 #endif // BUFFER_H
```

8.12 osdo/camera.cpp

#include "camera.h"
#include "conf.h"

camera.cpp:



- vec4 CAMERA_DIRECTION = CAMERA_DIRECTION_INIT

8.12.1

8.12.1.1 CAMERA_DIRECTION vec4 CAMERA_DIRECTION = CAMERA_DIRECTION_INIT

. camera.cpp, 4

8.13 camera.cpp

```
00001 #include "camera.h"
00002 #include "conf.h"
00003
00004 vec4 CAMERA_DIRECTION = CAMERA_DIRECTION_INIT;
00005
00006 Camera::Camera()
00007     : rotation GLM_MAT4_IDENTITY_INIT,
00008       position GLM_VEC4_BLACK_INIT,
00009       animation GLM_VEC3_ZERO_INIT {}
00010
00011 void Camera::get_position(vec4 position)
00012 {
00013     glm_vec4_copy(this->position, position);
```

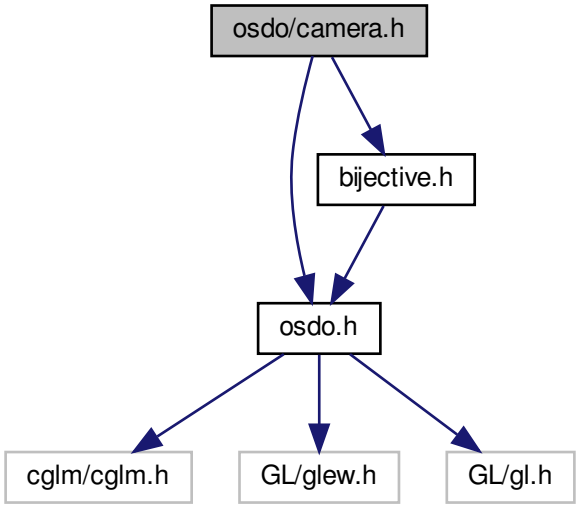
```
00014 }
00015
00016 void Camera::set_position(vec4 position)
00017 {
00018     glm_vec4_copy(position, this->position);
00019 }
00020
00021 void Camera::get_rotation(vec3 rotation)
00022 {
00023     glm_euler_angles(this->rotation, rotation);
00024 }
00025
00026 void Camera::set_rotation(vec3 rotation)
00027 {
00028     glm_euler_xyz(rotation, this->rotation);
00029 }
00030
00031 void Camera::get_animation(vec3 animation)
00032 {
00033     glm_vec3_copy(this->animation, animation);
00034 }
00035
00036 void Camera::set_animation(vec3 animation)
00037 {
00038     glm_vec3_copy(animation, this->animation);
00039 }
00040
00041 void Camera::get_mat4(mat4 dest) {
00042     Camera::get_rotation_mat4(dest);
00043     glm_translate(dest, this->position);
00044 }
00045
00046 void Camera::translate(
00047         vec3 distances, float delta_time) {
00048     vec3 new_distances = GLM_VEC3_ZERO_INIT;
00049     mat4 rotation;
00050     Camera::get_rotation_inv_mat4(rotation);
00051
00052     glm_vec3_muladds(distances, -OBJECT_MOVE_SPEED * delta_time,
00053                      new_distances);
00054     glm_vec3_rotate_m4(rotation, new_distances, new_distances);
00055     Camera::translate_camera(new_distances);
00056 }
00057
00058 void Camera::rotate(
00059         enum coord_enum coord, float delta_time) {
00060     Camera::rotate_camera(-OBJECT_ROTATE_SPEED * delta_time, coord);
00061 }
00062
00063 void Camera::rotate_all(vec3 angles) {
00064     Camera::rotate_camera(angles[0], X);
00065     Camera::rotate_camera(angles[1], Y);
00066     Camera::rotate_camera(angles[2], Z);
00067 }
00068
00069 void Camera::add_animation(
00070         vec3 angles, float delta_time) {
00071     vec3 animation;
00072     glm_vec3_muladds(angles, delta_time, animation);
00073     glm_vec3_add(this->animation, animation,
00074                  this->animation);
00075 }
00076
00077 void Camera::get_direction(vec4 dest) {
00078     mat4 matrix;
00079     Camera::get_rotation_inv_mat4(matrix);
00080     glm_mat4_mulv(matrix, CAMERA_DIRECTION, dest);
00081 }
00082
00083 void Camera::get_rotation_mat4(mat4 dest) {
00084     glm_mat4_copy(this->rotation, dest);
00085     glm_mat4_inv(dest, dest);
00086 }
00087
00088 void Camera::get_rotation_inv_mat4(mat4 dest) {
00089     glm_mat4_copy(this->rotation, dest);
00090 }
00091
00092 void Camera::translate_camera(vec3 distances) {
00093     glm_vec3_add(this->position, distances, this->position);
00094 }
00095
00096 void Camera::rotate_camera(float angle, enum coord_enum coord) {
00097     switch (coord) {
00098     case X: glm_rotate_x(this->rotation, angle, this->rotation); break;
00099     case Y: glm_rotate_y(this->rotation, angle, this->rotation); break;
00100     case Z: glm_rotate_z(this->rotation, angle, this->rotation); break;
```

```
00101     }
00102     /*if (glm_vec3_dot(this->rotation[2], GLM_XUP) > 0.1f) {
00103         glm_cross(this->rotation[2], GLM_XUP, this->rotation[1]);
00104         glm_cross(this->rotation[1], this->rotation[2], this->rotation[0]);
00105         glm_normalize(this->rotation[0]);
00106         glm_normalize(this->rotation[1]);
00107     }*/
00108 }
00109
00110 void Camera::rotate_all_camera(vec3 angles) {
00111     Camera::rotate_all(angles);
00112 }
00113
00114 void Camera::rotate_all_inverse(vec3 angles) {
00115     mat4 m = GLM_MAT4_IDENTITY_INIT;
00116     vec4 v = GLM_VEC4_BLACK_INIT;
00117
00118     glm_vec3_copy(rotation[0], v);
00119     glm_rotate(m, angles[0], v);
00120     glm_vec3_copy(rotation[1], v);
00121     glm_rotate(m, angles[1], v);
00122     glm_vec3_copy(rotation[2], v);
00123     glm_rotate(m, angles[2], v);
00124     glm_mat4_mul(m, rotation, rotation);
00125     glm_mat4_mulv(m, position, position);
00126 }
```

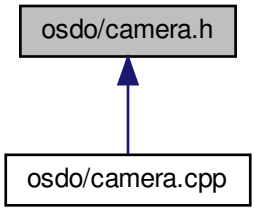
8.14 osdo/camera.h

, .

#include "osdo.h"
#include "bijective.h"
camera.h:



, :



- class Camera
  , .

- #define CAMERA_DIRECTION_INIT {0.0f, 0.0f, -1.0f, 0.0f}
  , .

8.14.1

, .

. camera.h

8.14.2

8.14.2.1 CAMERA_DIRECTION_INIT #define CAMERA_DIRECTION_INIT {0.0f, 0.0f, -1.0f, 0.0f}

, .

. camera.h, 14

8.15 camera.h

```
00001 /**
00002  * @file camera.h
00003  * @brief  ,     .
00004  */
00005 #ifndef CAMERA_H
00006 #define CAMERA_H
00007
00008 #include "osdo.h"
00009 #include "bijective.h"
00010
00011 /**
00012  * @brief ,       .
00013  */
00014 #define CAMERA_DIRECTION_INIT {0.0f, 0.0f, -1.0f, 0.0f}
00015
00016 /**
00017  * @brief  ,     .
00018  */
00019 class Camera : public Bijective {
00020     /**
00021      * @brief        .
00022      */
00023     mat4 rotation;
00024     /**
00025      * @brief    \f$(x, y, z, 1.0)\f$
00026      */
00027     vec4 position;
00028     /**
00029      * @brief ,     'Bijective'
00030      */
00031     vec4 animation;
00032 public:
00033     Camera();
00034
00035     /**
00036      * @brief      .
00037      * @param[out] position
00038      */
00039     void get_position(vec4 position) override;
00040     /**
00041      * @brief      .
00042      * @param[in] position
00043      */
00044     void set_position(vec4 position) override;
00045
00046     /**
00047      * @brief    .
00048      * @param[out] rotation
00049      */
00050     void get_rotation(vec3 rotation) override;
00051     /**
00052      * @brief    .
00053      * @param[in] rotation
00054      */
00055     void set_rotation(vec3 rotation) override;
00056
00057     /**
00058      * @brief     'Bijective'
00059      */
00060     void get_animation(vec3 animation) override;
00061     /**
00062      * @brief     'Bijective'
00063      */
00064     void set_animation(vec3 animation) override;
00065
00066     /**
00067      * @brief      .
00068      * @param[out] matrix
00069      */
00070     void get_mat4(mat4 matrix) override;
00071
00072     /**
00073      * @brief    .
00074      * @param[in] distances
00075      * @param[in] delta_time
00076      */
00077     void translate(vec3 distances, float delta_time) override;
00078     /**
00079      * @brief  .
00080      * @param[in] coord
00081      * @param[in] delta_time
00082      */
00083     void rotate(enum coord_enum coord, float delta_time) override;
00084     /**
00085      * @brief     .
```

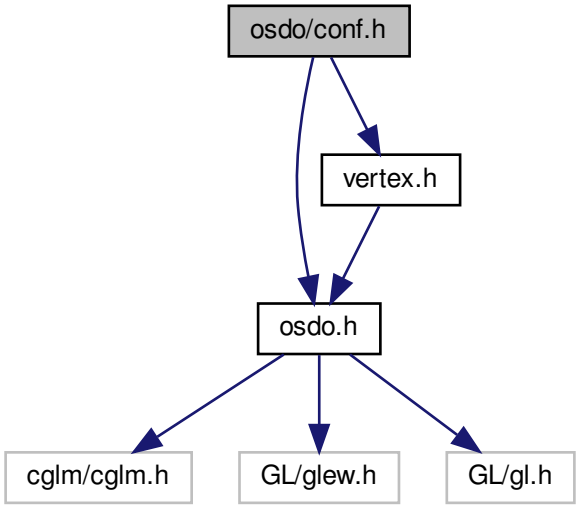
```
00086     * @param[in] angles
00087     */
00088    void rotate_all(vec3 angles) override;
00089    /**
00090     * @brief     'Bijective'
00091     */
00092    void add_animation(vec3 angles, float delta_time) override;
00093
00094    /**
00095     * @brief    .
00096     * @param[out] dest
00097     */
00098    void get_direction(vec4 dest);
00099    /**
00100     * @brief    .
00101     * @param[out] dest    .
00102     */
00103    void get_rotation_mat4(mat4 dest);
00104    /**
00105     * @brief     .
00106     * @param[out] dest     .
00107     */
00108    void get_rotation_inv_mat4(mat4 dest);
00109
00110    /**
00111     * @brief     .
00112     * @param distances       \f$(x, y, z)\f$
00113     */
00114    void translate_camera(vec3 distances);
00115
00116    /**
00117     * @brief       .
00118     * @param angle
00119     * @param coord
00120     */
00121    void rotate_camera(float angle, enum coord_enum coord);
00122    /**
00123     * @brief        .
00124     * @param angles       \f$(x, y, z)\f$
00125     */
00126    void rotate_all_camera(vec3 angles);
00127
00128    /**
00129     * @brief       .
00130     * @param angles         \f$(x, y, z)\f$
00131     */
00132    void rotate_all_inverse(vec3 angles);
00133
00134 };
00135
00136 #endif // CAMERA_H
```

8.16 osdo/conf.h

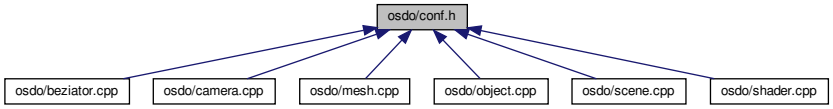
osdo

#include "osdo.h"
#include "vertex.h"

conf.h:



, :



- #define M_PI 3.14159265358979323846
  double
- #define M_RAD M_PI / 180
  double
- #define M_PI_F 3.14159265358979323846f
- #define M_RAD_F M_PI_F / 180
  float
- #define RES_DIR "../share/osdo"
  float
- #define VERTEX_PATH RES_DIR"/%s.vert"
- #define TESC_PATH RES_DIR"/%s.tesc"
- #define TESE_PATH RES_DIR"/%s.tese"

- #define GEOMETRY_PATH RES_DIR"/%s.geom"
- #define FRAGMENT_PATH RES_DIR"/%s.frag"
- #define BEZIATOR_PATH RES_DIR"/%s.odom"
- #define MAX_VERTEX_BUFFER 512 * 1024
- #define MAX_ELEMENT_BUFFER 128 * 1024
- #define NK_GLFW_DOUBLE_CLICK_LO 0.02
- #define NK_GLFW_DOUBLE_CLICK_HI 0.2

8.16.1

osdo

. conf.h

8.16.2

8.16.2.1 BEZIATOR_PATH #define BEZIATOR_PATH RES_DIR"/%s.odom"

. conf.h, 56

8.16.2.2 FRAGMENT_PATH #define FRAGMENT_PATH RES_DIR"/%s.frag"

. conf.h, 52

8.16.2.3 GEOMETRY_PATH #define GEOMETRY_PATH RES_DIR"/%s.geom"

. conf.h, 48

8.16.2.4 M_PI #define M_PI 3.14159265358979323846

double

. conf.h, 14

8.16.2.5 M_PI_F #define M_PI_F 3.14159265358979323846f

. conf.h, 19

8.16.2.6 M_RAD #define M_RAD M_PI / 180

double

. conf.h, 18

8.16.2.7 M_RAD_F #define M_RAD_F M_PI_F / 180

float

. conf.h, 23

8.16.2.8 MAX_ELEMENT_BUFFER #define MAX_ELEMENT_BUFFER 128 * 1024

. conf.h, 65

8.16.2.9 MAX_VERTEX_BUFFER #define MAX_VERTEX_BUFFER 512 * 1024

. conf.h, 61

8.16.2.10 NK_GLFW_DOUBLE_CLICK_HI #define NK_GLFW_DOUBLE_CLICK_HI 0.2

. conf.h, 74

8.16.2.11 NK_GLFW_DOUBLE_CLICK_LO #define NK_GLFW_DOUBLE_CLICK_LO 0.02

. conf.h, 70

8.16.2.12 RES_DIR #define RES_DIR "../share/osdo"

float

osdo

. conf.h, 31

8.16.2.13 TESC_PATH #define TESC_PATH RES_DIR"/%s.tesc"

. conf.h, 40

8.16.2.14 TESE_PATH #define TESE_PATH RES_DIR"/%s.tese"

. conf.h, 44

8.16.2.15 VERTEX_PATH #define VERTEX_PATH RES_DIR"/%s.vert"

. conf.h, 36

8.17 conf.h

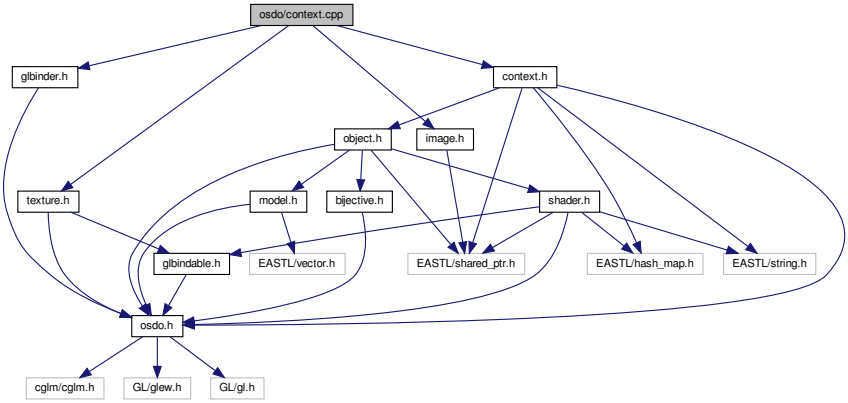
```
00001 /**
00002  * @file conf.h
00003  * @brief   ‘osdo‘
00004  */
00005 #ifndef CONF_H
00006 #define CONF_H
00007
00008 #include "osdo.h"
00009 #include "vertex.h"
00010
00011 /**
00012  * @brief     ‘double‘
00013  */
00014 #define M_PI 3.14159265358979323846
00015 /**
00016  * @brief      ‘double‘
00017  */
00018 #define M_RAD M_PI / 180
00019 #define M_PI_F 3.14159265358979323846f
00020 /**
00021  * @brief     ‘float‘
00022  */
00023 #define M_RAD_F M_PI_F / 180
00024 /**
00025  * @brief      ‘float‘
00026  */
00027
00028 /**
00029  * @brief      ‘osdo‘
00030  */
00031 #define RES_DIR "../share/osdo"
00032
00033 /**
00034  * @brief
00035  */
00036 #define VERTEX_PATH RES_DIR"/%s.vert"
00037 /**
00038  * @brief
00039  */
00040 #define TESC_PATH RES_DIR"/%s.tesc"
00041 /**
00042  * @brief
00043  */
00044 #define TESE_PATH RES_DIR"/%s.tese"
00045 /**
00046  * @brief
00047  */
00048 #define GEOMETRY_PATH RES_DIR"/%s.geom"
00049 /**
00050  * @brief
00051  */
00052 #define FRAGMENT_PATH RES_DIR"/%s.frag"
00053 /**
00054  * @brief
00055  */
00056 #define BEZIATOR_PATH RES_DIR"/%s.odom"
00057
00058 /**
00059  * @brief
00060  */
00061 #define MAX_VERTEX_BUFFER 512 * 1024
00062 /**
00063  * @brief
00064  */
00065 #define MAX_ELEMENT_BUFFER 128 * 1024
00066
00067 /**
00068  * @brief
00069  */
00070 #define NK_GLFW_DOUBLE_CLICK_LO 0.02
00071 /**
00072  * @brief
00073  */
00074 #define NK_GLFW_DOUBLE_CLICK_HI 0.2
00075
00076 /**
00077  * @brief
00078  */
00079 static const unsigned int SCR_WIDTH = 1366;
00080 /**
00081  * @brief
00082  */
00083 static const unsigned int SCR_HEIGHT = 700;
00084
00085 /**
```

```
00086  * @brief   '
00087  */
00088 static const float OBJECT_MOVE_SPEED   =  5.0f;
00089 /**
00090  * @brief   '
00091  */
00092 static const float OBJECT_ROTATE_SPEED =  1.0f;
00093 /**
00094  * @brief      '
00095  */
00096 static const float OBJECT_ANIMATE_SPEED = 1.0f;
00097
00098 /**
00099  * @brief
00100  */
00101 static const float SENSITIVITY = 0.01f;
00102
00103 /**
00104  * @brief     (   )
00105  */
00106 static vec3 UNUSED LAMP_POSITIONS[] = {
00107     {5.0f, 0.0f, 5.0f},
00108     {-1.0f, 0.0f, 1.0f}
00109 };
00110
00111 /**
00112  * @brief
00113  */
00114 static const Vertex EXAMPLE_CUBE_VERTEX[] = {
00115     {{-1.,  1., -1.}, { 0.,  1.,  0.}, {  0, 255,   0, 255}, {0., 0.}},
00116     {{ 1.,  1.,  1.}, { 0.,  1.,  0.}, {255, 255, 255, 255}, {0., 0.}},
00117     {{ 1.,  1., -1.}, { 0.,  1.,  0.}, {255, 255,   0, 255}, {0., 0.}},
00118
00119     {{ 1.,  1.,  1.}, { 0.,  0.,  1.}, {255, 255, 255, 255}, {0., 0.}},
00120     {{-1., -1.,  1.}, { 0.,  0.,  1.}, {  0,   0, 255, 255}, {0., 0.}},
00121     {{ 1., -1.,  1.}, { 0.,  0.,  1.}, {255,   0, 255, 255}, {0., 0.}},
00122
00123     {{-1.,  1.,  1.}, {-1.,  0.,  0.}, {  0, 255, 255, 255}, {0., 0.}},
00124     {{-1., -1., -1.}, {-1.,  0.,  0.}, {  0,   0,   0, 255}, {0., 0.}},
00125     {{-1., -1.,  1.}, {-1.,  0.,  0.}, {  0,   0, 255, 255}, {0., 0.}},
00126
00127     {{ 1., -1., -1.}, { 0., -1.,  0.}, {255,   0,   0, 255}, {0., 0.}},
00128     {{-1., -1.,  1.}, { 0., -1.,  0.}, {  0,   0, 255, 255}, {0., 0.}},
00129     {{-1., -1., -1.}, { 0., -1.,  0.}, {  0,   0,   0, 255}, {0., 0.}},
00130
00131     {{ 1.,  1., -1.}, { 1.,  0.,  0.}, {255, 255,   0, 255}, {0., 0.}},
00132     {{ 1., -1.,  1.}, { 1.,  0.,  0.}, {255,   0, 255, 255}, {0., 0.}},
00133     {{ 1., -1., -1.}, { 1.,  0.,  0.}, {255,   0,   0, 255}, {0., 0.}},
00134
00135     {{-1.,  1., -1.}, { 0.,  0., -1.}, {  0, 255,   0, 255}, {0., 0.}},
00136     {{ 1., -1., -1.}, { 0.,  0., -1.}, {255,   0,   0, 255}, {0., 0.}},
00137     {{-1., -1., -1.}, { 0.,  0., -1.}, {  0,   0,   0, 255}, {0., 0.}},
00138
00139     {{-1.,  1., -1.}, { 0.,  1.,  0.}, {  0, 255,   0, 255}, {0., 0.}},
00140     {{-1.,  1.,  1.}, { 0.,  1.,  0.}, {  0, 255, 255, 255}, {0., 0.}},
00141     {{ 1.,  1.,  1.}, { 0.,  1.,  0.}, {255, 255, 255, 255}, {0., 0.}},
00142
00143     {{ 1.,  1.,  1.}, { 0.,  0.,  1.}, {255, 255, 255, 255}, {0., 0.}},
00144     {{-1.,  1.,  1.}, { 0.,  0.,  1.}, {  0, 255, 255, 255}, {0., 0.}},
00145     {{-1., -1.,  1.}, { 0.,  0.,  1.}, {  0,   0, 255, 255}, {0., 0.}},
00146
00147     {{-1.,  1.,  1.}, {-1.,  0.,  0.}, {  0, 255, 255, 255}, {0., 0.}},
00148     {{-1.,  1., -1.}, {-1.,  0.,  0.}, {  0, 255,   0, 255}, {0., 0.}},
00149     {{-1., -1., -1.}, {-1.,  0.,  0.}, {  0,   0,   0, 255}, {0., 0.}},
00150
00151     {{ 1., -1., -1.}, { 0., -1.,  0.}, {255,   0,   0, 255}, {0., 0.}},
00152     {{ 1., -1.,  1.}, { 0., -1.,  0.}, {255,   0, 255, 255}, {0., 0.}},
00153     {{-1., -1.,  1.}, { 0., -1.,  0.}, {  0,   0, 255, 255}, {0., 0.}},
00154
00155     {{ 1.,  1., -1.}, { 1.,  0.,  0.}, {255, 255,   0, 255}, {0., 0.}},
00156     {{ 1.,  1.,  1.}, { 1.,  0.,  0.}, {255, 255, 255, 255}, {0., 0.}},
00157     {{ 1., -1.,  1.}, { 1.,  0.,  0.}, {255,   0, 255, 255}, {0., 0.}},
00158
00159     {{-1.,  1., -1.}, { 0.,  0., -1.}, {  0, 255,   0, 255}, {0., 0.}},
00160     {{ 1.,  1., -1.}, { 0.,  0., -1.}, {255, 255,   0, 255}, {0., 0.}},
00161     {{ 1., -1., -1.}, { 0.,  0., -1.}, {255,   0,   0, 255}, {0., 0.}},
00162 };
00163
00164 /**
00165  * @brief  ,    .
00166  */
00167 static const GLuint EXAMPLE_CUBE_INDICIES[] = {
00168      0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11,
00169     12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23,
00170     24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35,
00171 };
00172
```

00173 #endif // CONF_H

8.18 osdo/context.cpp

#include "context.h"
#include "glbinder.h"
#include "image.h"
#include "texture.h"
context.cpp:



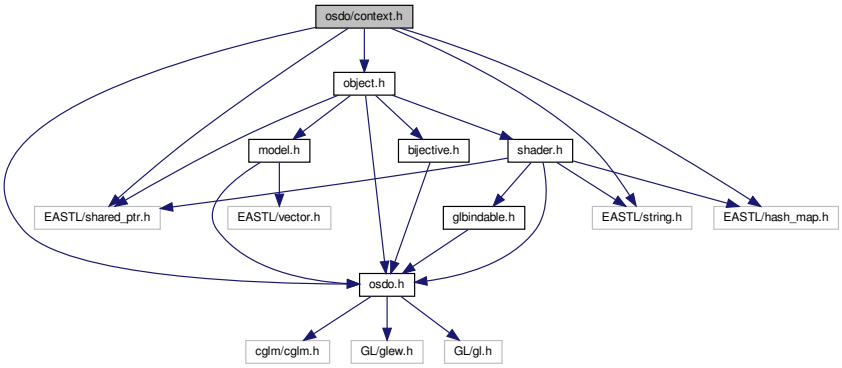
8.19 context.cpp

```
00001 #include "context.h"
00002 #include "glbinder.h"
00003 #include "image.h"
00004 #include "texture.h"
00005
00006 Context::Context() : active(models.end()), active_texture(textures.end()) {
00007
00008 }
00009
00010 Context::Models::iterator &Context::next_active() {
00011     if (active == models.end()) {
00012         active = models.begin();
00013     } else active++;
00014     return active;
00015 }
00016
00017 void Context::load_texture(const char *path) {
00018     Image img = Image::fromFile(path);
00019     if (img.data) {
00020         auto tex = make_shared<Texture>();
00021         tex->update(img);
00022         textures[path] = tex;
00023     }
00024 }
00025
00026 bool Context::load_shader(const char *name, const Shader::shader_map& shaders) {
00027     auto shader = Shader::create(shaders);
00028     if (!shader)
00029         return false;
00030     this->shaders[string(name)] = shader;
00031     return true;
00032 }
```

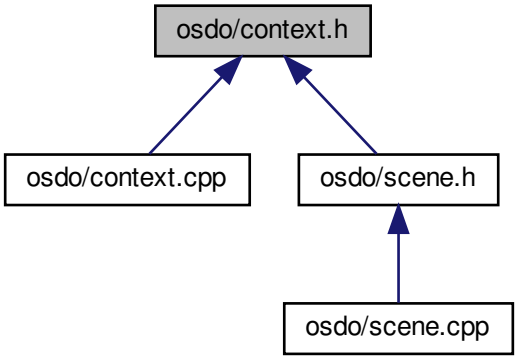
8.20 osdo/context.h

, ' .

#include "osdo.h"
#include "object.h"
#include "EASTL/hash_map.h"
#include "EASTL/string.h"
#include "EASTL/shared_ptr.h"
context.h:



, :



- struct Context
  , '.

8.20.1

, '.

. context.h

8.21 context.h

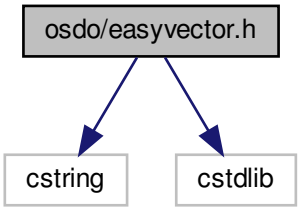
```
00001 /**
00002  * @file context.h
00003  * @brief ,       ' .
00004  */
00005 #ifndef CONTEXT_H
00006 #define CONTEXT_H
00007
00008 #include "osdo.h"
00009
00010 #include "object.h"
00011 #include "EASTL/hash_map.h"
00012 #include "EASTL/string.h"
00013 #include "EASTL/shared_ptr.h"
00014 using eastl::hash_map;
00015 using eastl::string;
00016 using eastl::shared_ptr;
00017 using eastl::pair;
00018 using eastl::make_shared;
00019
00020 class Shader;
00021 class Texture;
00022
00023 /**
00024  * @brief ,       ' .
00025  */
00026 struct Context
00027 {
00028     /**
00029      * @brief    .
00030      */
00031     typedef hash_map<string, Object> Models;
00032     /**
00033      * @brief    .
00034      */
00035     typedef hash_map<string, shared_ptr<Texture» Textures;
00036     /**
00037      * @brief  .
00038      */
00039     Models models;
00040     /**
00041      * @brief  .
00042      */
00043     hash_map<string, shared_ptr<Shader» shaders;
00044     /**
00045      * @brief  .
00046      */
00047     Textures textures;
00048
00049     /**
00050      * @brief    .
00051      */
00052     Models::iterator active;
00053     /**
00054      * @brief    .
00055      */
00056     Textures::iterator active_texture;
00057
00058 public:
00059     Context();
00060
00061     /**
00062      * @brief      .
00063      * @return
00064      */
00065     Models::iterator &next_active();
00066
00067     /**
00068      * @brief    '.
00069      * @param[in] path
00070      */
00071     void load_texture(const char *path);
00072
00073     /**
00074      * @brief    .
00075      * @param name
00076      * @param shaders
00077      * @return
00078      */
00079     bool load_shader(const char *name, const Shader::shader_map& shaders);
00080
00081     /**
00082      * @brief
00083      * @param path
00084      * @return
00085      */
```

```
00086     bool load_model(const string& path);
00087 };
00088
00089 #endif // CONTEXT_H
```

8.22 osdo/easyvector.h

.

#include <cstring>
#include <cstdlib>
easyvector.h:



- class OSDO::vector< T >
  .

- OSDO
  osdo

8.22.1

.

. easyvector.h

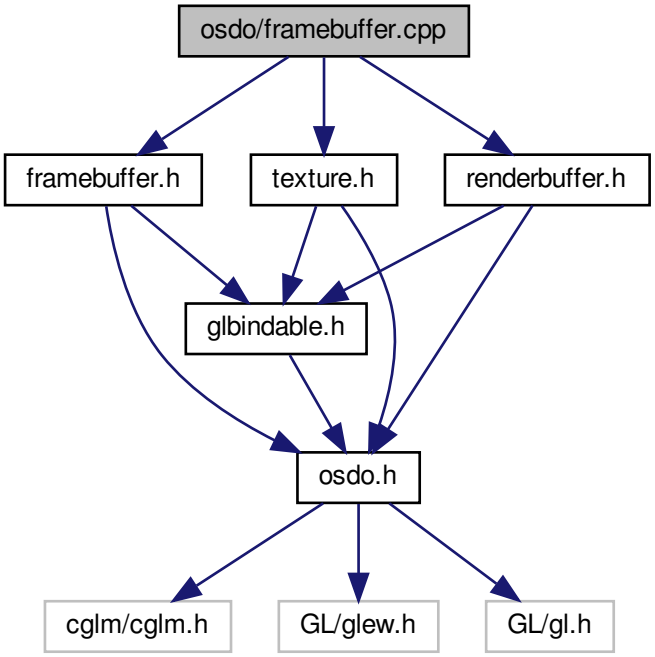
8.23 easyvector.h

```
00001 /**
00002  * @file easyvector.h
00003  * @brief      .
00004  */
00005 #ifndef EASYVECTOR_H
00006 #define EASYVECTOR_H
00007
00008 #include <cstring>
00009 #include <cstdlib>
00010
00011 /**
00012  * @brief   'osdo'
00013  */
00014 namespace OSDO {
00015 /**
00016  * @brief      .
00017  */
00018     template<class T>
00019     class vector {
00020         /**
00021          * @brief     'T'
00022          */
00023         T * arr;
00024         /**
00025          * @brief    .
00026          */
00027         size_t _size;
00028         /**
00029          * @brief    'size'
00030          * @param size
00031          */
00032         void _allocate(size_t size) {
00033             _size = 0;
00034             arr = nullptr;
00035             if (size)
00036                 arr = static_cast<T*>(calloc(size, sizeof(T)));
00037             if (arr)
00038                 _size = size;
00039         }
00040         /**
00041          * @brief  '  .
00042          */
00043         void _free() {
00044             if (arr)
00045                 free(arr);
00046             _size = 0;
00047             arr = nullptr;
00048         }
00049         /**
00050          * @brief  .
00051          * @param vector
00052          */
00053         void _copy(const vector& vector) {
00054             _allocate(vector._size);
00055             if (_size)
00056                 memcpy(arr, vector.arr, _size * sizeof(T));
00057         }
00058         /**
00059          * @brief     .
00060          * @param vector
00061          */
00062         void _move(vector& vector) {
00063             arr = vector.arr;
00064             _size = vector._size;
00065         }
00066     public:
00067         /**
00068          * @brief
00069          * @param size
00070          */
00071         vector(size_t size = 0) {
00072             _allocate(size);
00073         }
00074         /**
00075          * @brief
00076          * @param vector
00077          */
00078         vector(vector&& vector) {
00079             _copy(vector);
00080         }
00081         /**
00082          * @brief
00083          * @param vector
00084          */
00085         vector(const vector& vector) {
```

```
00086             _copy(vector);
00087         }
00088         ~vector() {_free();}
00089         vector &operator=(vector&& vector) {
00090             _free();
00091             _copy(vector);
00092             return *this;
00093         }
00094         vector &operator=(const vector& vector) {
00095             _free();
00096             _copy(vector);
00097             return *this;
00098         }
00099         T &operator[](size_t i) {
00100             return arr[i];
00101         }
00102         size_t size() const {
00103             return _size;
00104         }
00105         T * data() {
00106             return arr;
00107         }
00108         const T * data() const {
00109             return arr;
00110         }
00111         void clear() {
00112             *this = vector(0);
00113         }
00114     };
00115 }
00116
00117 #endif // EASYVECTOR_H
```

8.24 osdo/framebuffer.cpp

#include "framebuffer.h"
#include "texture.h"
#include "renderbuffer.h"
framebuffer.cpp:



8.25 framebuffer.cpp

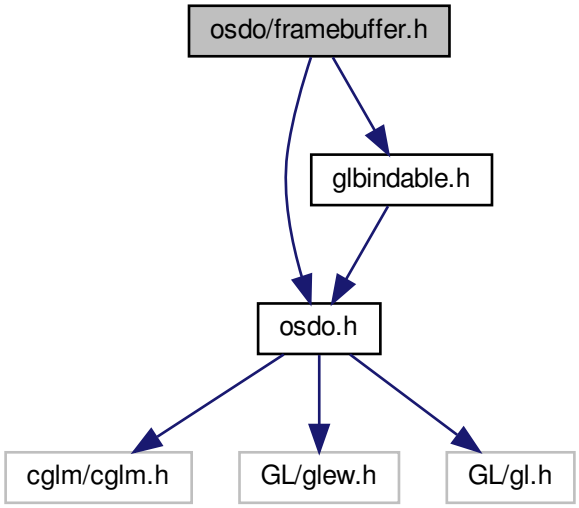
```
00001 #include "framebuffer.h"
00002 #include "texture.h"
00003 #include "renderbuffer.h"
00004
00005 GLuint Framebuffer::_generate() const
00006 {
00007     GLuint id;
00008     glGenFramebuffers(1, &id);
00009     return id;
00010 }
00011
00012 void Framebuffer::_bind(const GLuint id, GLenum target) const
00013 {
00014     glBindFramebuffer(target, id);
00015 }
00016
00017 GLenum Framebuffer::_default() const
00018 {
00019     return GL_FRAMEBUFFER;
00020 }
00021
00022 Framebuffer::Framebuffer() : GlBindable(_generate()) {}
00023
00024 Framebuffer::~Framebuffer() {
00025     glDeleteFramebuffers(1, &get_id());
00026 }
00027
00028 bool Framebuffer::check(GLenum target) {
00029     return glCheckFramebufferStatus(target) == GL_FRAMEBUFFER_COMPLETE;
00030 }
00031
00032 void Framebuffer::tex_2d_multisample(GLsizei size[2], const Texture &texture) {
00033     texture.make_2d_multisample(size);
00034     glFramebufferTexture2D(GL_FRAMEBUFFER, GL_COLOR_ATTACHMENT0,
00035                            GL_TEXTURE_2D_MULTISAMPLE, texture.get_id(), 0);
00036 }
00037
00038 void Framebuffer::tex_2d(GLsizei size[2], const Texture &texture) {
00039     texture.make_2d(size);
00040     glFramebufferTexture(GL_FRAMEBUFFER, GL_COLOR_ATTACHMENT0,
00041                          texture.get_id(), 0);
00042 }
00043
00044 void Framebuffer::renderbuffer(const Renderbuffer &rb, GLenum target) const {
00045     glFramebufferRenderbuffer(GL_FRAMEBUFFER, target,
00046                               GL_RENDERBUFFER, rb.get_id());
00047 }
00048
00049 void Framebuffer::rb_color_multisample(
00050         GLsizei size[2], const Renderbuffer &rb) const {
00051     rb.make_multisample(size, GL_RGB);
00052     renderbuffer(rb, GL_COLOR_ATTACHMENT0);
00053 }
00054
00055 void Framebuffer::rb_depth_multisample(
00056         GLsizei size[2], const Renderbuffer &rb) const {
00057     rb.make_multisample(size, GL_DEPTH32F_STENCIL8);
00058     renderbuffer(rb, GL_DEPTH_STENCIL_ATTACHMENT);
00059 }
00060
00061 void Framebuffer::rb_color(GLsizei size[2], const Renderbuffer &rb) const {
00062     rb.make(size, GL_RGB);
00063     renderbuffer(rb, GL_COLOR_ATTACHMENT0);
00064 }
00065
00066
00067 void Framebuffer::rb_depth(GLsizei size[2], const Renderbuffer &rb) const {
00068     rb.make(size, GL_DEPTH32F_STENCIL8);
00069     renderbuffer(rb, GL_DEPTH_STENCIL_ATTACHMENT);
00070 }
```

8.26 osdo/framebuffer.h

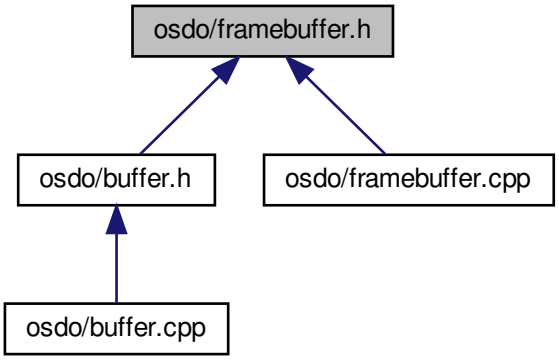
, .

#include "osdo.h"
#include "glbindable.h"

framebuffer.h:



, :



- class Framebuffer

, .

8.26.1

, .

. framebuffer.h

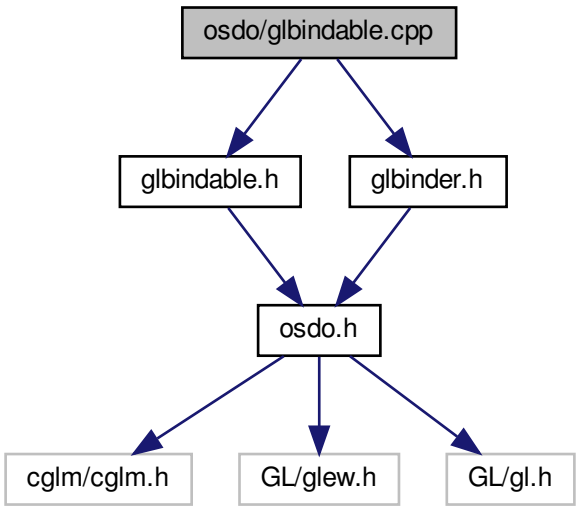
8.27 framebuffer.h

```
00001 /**
00002  * @file framebuffer.h
00003  * @brief  ,    .
00004  */
00005 #ifndef FRAMEBUFFER_H
00006 #define FRAMEBUFFER_H
00007
00008 #include "osdo.h"
00009 #include "glbindable.h"
00010
00011 class Renderbuffer;
00012 class Texture;
00013
00014 /**
00015  * @brief  ,    .
00016  */
00017 class Framebuffer : public GlBindable
00018 {
00019     /**
00020      * @brief      .
00021      * @return
00022      */
00023     GLuint _generate() const override;
00024     /**
00025      * @brief  ,  '    .
00026      * @param id
00027      * @param target
00028      */
00029     virtual void _bind(const GLuint id, GLenum target) const override;
00030     /**
00031      * @brief  ,    '  .
00032      * @return   '
00033      */
00034     virtual GLenum _default() const override;
00035 public:
00036     Framebuffer();
00037     ~Framebuffer() override;
00038
00039     /**
00040      * @brief ,     .
00041      * @param target
00042      * @return
00043      */
00044     bool check(GLenum target = GL_FRAMEBUFFER);
00045
00046     /**
00047      * @brief
00048      * @param size
00049      * @param texture
00050      */
00051     void tex_2d_multisample(GLsizei size[2], const Texture& texture);
00052
00053     /**
00054      * @brief
00055      * @param size
00056      * @param texture
00057      */
00058     void tex_2d(GLsizei size[2], const Texture& texture);
00059
00060     /**
00061      * @brief    'rb'
00062      * @param rb
00063      * @param target
00064      */
00065     void renderbuffer(const Renderbuffer& rb, GLenum target) const;
00066
00067     /**
00068      * @brief        .
00069      * @param size
00070      * @param rb
00071      */
00072     void rb_color_multisample(GLsizei size[2], const Renderbuffer& rb) const;
00073
00074     /**
00075      * @brief      .
00076      * @param size
00077      * @param rb
00078      */
00079     void rb_depth_multisample(GLsizei size[2], const Renderbuffer& rb) const;
00080
00081     /**
00082      * @brief      .
00083      * @param size
00084      * @param rb
00085      */
```

```
00086     void rb_color(GLsizei size[2], const Renderbuffer& rb) const;
00087
00088     /**
00089      * @brief    .
00090      * @param size
00091      * @param rb
00092      */
00093     void rb_depth(GLsizei size[2], const Renderbuffer& rb) const;
00094 };
00095
00096 #endif // FRAMEBUFFER_H
```

8.28 osdo/glbindable.cpp

#include "glbindable.h"
#include "glbinder.h"
glbindable.cpp:



8.29 glbindable.cpp

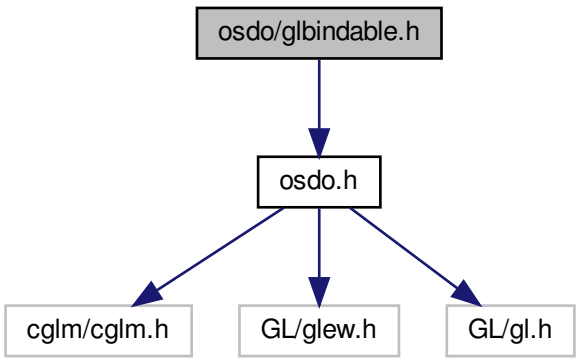
```
00001 #include "glbindable.h"
00002 #include "glbinder.h"
00003
00004 GLuint GlBindable::_generate() const {
00005     return 0;
00006 }
00007
00008 void GlBindable::_bind(const GLuint, GLenum) const {}
00009
00010 GLenum GlBindable::_default() const {
00011     return 0;
00012 }
00013
00014 GlBindable::GlBindable() : id(_generate()) {}
00015
00016 GlBindable::GlBindable(const GLuint id) : id(id) {}
00017
00018 GlBindable::~GlBindable() {}
00019
00020 const GLuint &GlBindable::get_id() const
00021 {
00022     return id;
```

```
00023 }
00024
00025 void *GlBindable::get_vid() const
00026 {
00027     return reinterpret_cast<void*>(static_cast<intptr_t>(id));
00028 }
00029
00030 void GlBindable::bind() const
00031 {
00032     _bind(id, _default());
00033 }
00034
00035 void GlBindable::bind(GLenum target) const
00036 {
00037     _bind(id, target);
00038 }
00039
00040 void GlBindable::unbind() const
00041 {
00042     _bind(0, _default());
00043 }
00044
00045 void GlBindable::unbind(GLenum target) const
00046 {
00047     _bind(0, target);
00048 }
00049
00050 GlBinder GlBindable::binder() const
00051 {
00052     return {*this, _default()};
00053 }
00054
00055 GlBinder GlBindable::binder(GLenum target) const
00056 {
00057     return {*this, target};
00058 }
00059
00060
```

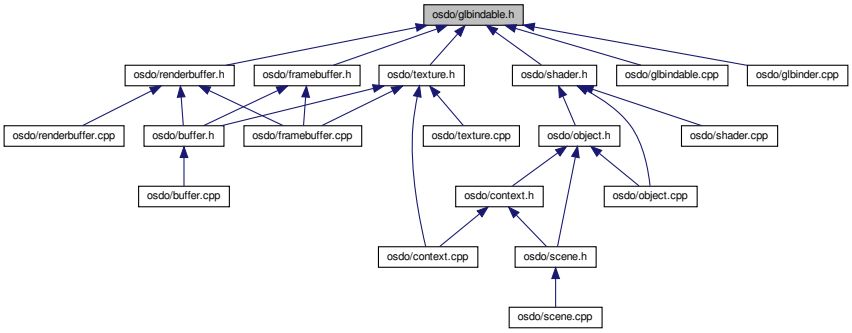
8.30 osdo/glbindable.h

, ' ' OpenGL.

#include "osdo.h"
glbindable.h:



, :



- class GlBindable
  , ' ' OpenGL.

8.30.1

, ' ' OpenGL.

. glbindable.h

8.31 glbindable.h

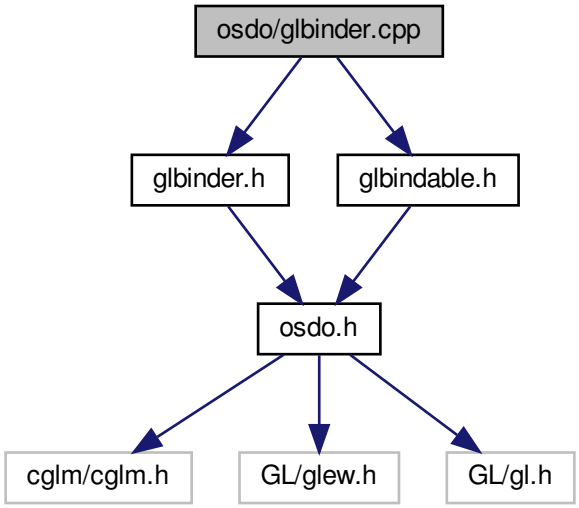
```
00001 /**
00002  * @file glbindable.h
00003  * @brief  ,      ' ' OpenGL.
00004  */
00005 #ifndef GLBINDABLE_H
00006 #define GLBINDABLE_H
00007
00008 #include "osdo.h"
00009
00010 class GlBinder;
00011
00012 /**
00013  * @brief  ,      ' ' OpenGL.
00014  */
00015 class GlBindable
00016 {
00017     /**
00018      * @brief  ' OpenGL.
00019      */
00020     const GLuint id;
00021 protected:
00022     /**
00023      * @brief     '.
00024      * @return  ' OpenGL
00025      */
00026     virtual GLuint _generate() const;
00027     /**
00028      * @brief  ,  '  OpenGL  '.
00029      * @param id  ' OpenGL
00030      * @param target  ' '
00031      */
00032     virtual void _bind(const GLuint id, GLenum target) const;
00033     /**
00034      * @brief  ,    '  .
00035      * @return  '
00036      */
00037     virtual GLenum _default() const;
```

```
00038 protected:
00039     GlBindable();
00040     /**
00041      * @brief   .
00042      * @param id  ' OpenGL
00043      */
00044     GlBindable(const GLuint id);
00045 public:
00046     virtual ~GlBindable();
00047
00048     GlBindable(const GlBindable&) = delete;
00049     GlBindable(GlBindable&&) = delete;
00050     GlBindable& operator=(const GlBindable&) = delete;
00051     GlBindable& operator=(GlBindable&&) = delete;
00052
00053     /**
00054      * @brief   ' OpenGL.
00055      * @return  ' OpenGL
00056      */
00057     const GLuint& get_id() const;
00058     /**
00059      * @brief   ' OpenGL   'void*'
00060      * @return  ' OpenGL
00061      */
00062     void* get_vid() const;
00063
00064     /**
00065      * @brief '   '    .
00066      */
00067     void bind() const;
00068     /**
00069      * @brief '   '   'target'
00070      * @param target  ' '
00071      */
00072     void bind(GLenum target) const;
00073     /**
00074      * @brief '   '    .
00075      */
00076     void unbind() const;
00077     /**
00078      * @brief '   '   'target'
00079      * @param target  ' '
00080      */
00081     void unbind(GLenum target) const;
00082
00083     /**
00084      * @brief  ' '
00085      * @return ' '
00086      */
00087     GlBinder binder() const;
00088     /**
00089      * @brief  ' '    'target'
00090      * @param target  ' '
00091      * @return ' '    'target'
00092      */
00093     GlBinder binder(GLenum target) const;
00094 };
00095
00096 #endif // GLBINDABLE_H
```

8.32 osdo/glbinder.cpp

```
#include "glbinder.h"
#include "glbindable.h"
```

glbinder.cpp:



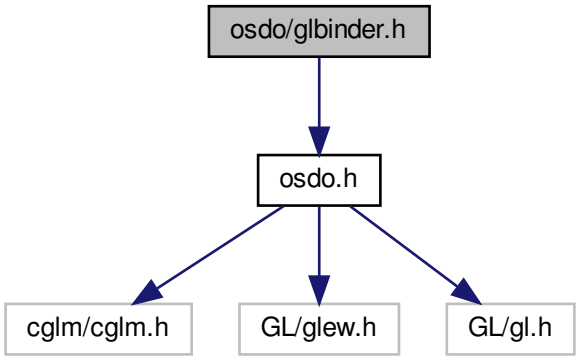
8.33 glbinder.cpp

```
00001 #include "glbinder.h"
00002 #include "glbindable.h"
00003
00004
00005 GlBinder::GlBinder(const GlBindable &bindable, GLenum target)
00006     : bindable(bindable), target(target) {
00007     bindable.bind(target);
00008 }
00009
00010 GlBinder::~GlBinder() {bindable.unbind(target);}
```

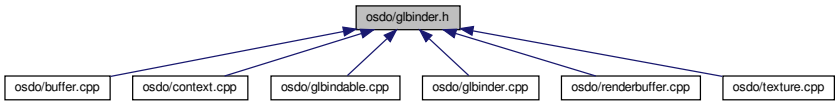
8.34 osdo/glbinder.h

' ' OpenGL.

#include "osdo.h"
glbinder.h:



, :



- class GlBinder
  ' ' OpenGL.

8.34.1

' ' OpenGL.

. glbinder.h

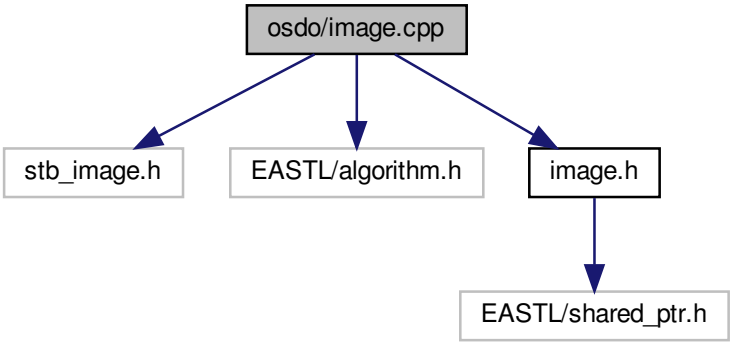
8.35 glbinder.h

```
00001 /**
00002  * @file glbinder.h
00003  * @brief   '    ' OpenGL.
00004  */
00005 #ifndef GLBINDER_H
00006 #define GLBINDER_H
00007
00008 #include "osdo.h"
00009
00010 class GlBindable;
00011
00012 /**
```

```
00013  * @brief   '    ' OpenGL.
00014  */
00015 class GlBinder
00016 {
00017     /**
00018      * @brief ' OpenGL,  '.
00019      */
00020     const GlBindable& bindable;
00021     /**
00022      * @brief  '.
00023      */
00024     const GLenum target;
00025 public:
00026     /**
00027      * @brief
00028      * @param bindable ' OpenGL,  '
00029      * @param target  '
00030      */
00031     GlBinder(const GlBindable& bindable, GLenum target);
00032     ~GlBinder();
00033 };
00034
00035 #endif // GLBINDER_H
```

8.36 osdo/image.cpp

#include <stb_image.h>
#include <EASTL/algorithm.h>
#include "image.h"
image.cpp:



- #define STB_IMAGE_IMPLEMENTATION

8.36.1

8.36.1.1 STB_IMAGE_IMPLEMENTATION #define STB_IMAGE_IMPLEMENTATION

. image.cpp, 1

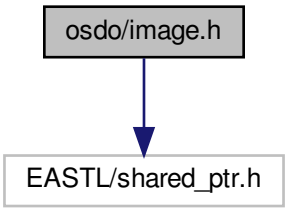
8.37 image.cpp

```
00001 #define STB_IMAGE_IMPLEMENTATION
00002 #include <stb_image.h>
00003 #include <EASTL/algorithm.h>
00004 #include "image.h"
00005
00006 using eastl::min;
00007 using eastl::max;
00008
00009 Image::Image(shared_ptr<const pixel_t[]> data,
00010              const int width, const int height)
00011     : data(data), width(width), height(height)
00012 {
00013 }
00014
00015 Image Image::fromFile(const char *path)
00016 {
00017     int width = 0, height = 0;
00018     pixel_t (*data)[] = (pixel_t (*)[])stbi_load(path, &width, &height, nullptr, COMP);
00019     if (data) {
00020         shared_ptr<pixel_t[]> ptr(data, stbi_image_free);
00021         return {ptr, width, height};
00022     }
00023     return {nullptr, 0, 0};
00024 }
```

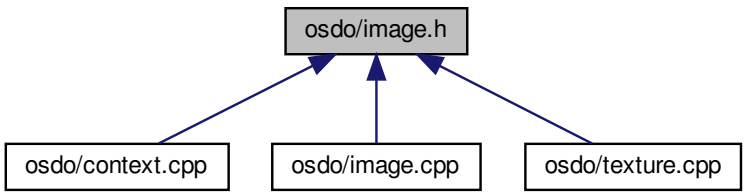
8.38 osdo/image.h

, , .

#include <EASTL/shared_ptr.h>
image.h:



, :



- class Image
  , .

- #define COMP 4

- typedef unsigned char channel_t
  . unsigned char, [0, 255], 8-.
- typedef channel_t pixel_t[COMP]
  . COMP channel_t. 8- , [0, 255]. 4 (, ,), 4 .

8.38.1

, , .

. image.h

8.38.2

8.38.2.1 COMP #define COMP 4

"" stb_image.h.

. image.h, 14

8.38.3

8.38.3.1 channel_t typedef unsigned char channel_t

. unsigned char, [0, 255], 8-.

. image.h, 23

8.38.3.2 pixel_t typedef channel_t pixel_t[COMP]

. COMP channel_t. 8- , [0, 255]. 4 (, ,), 4 .

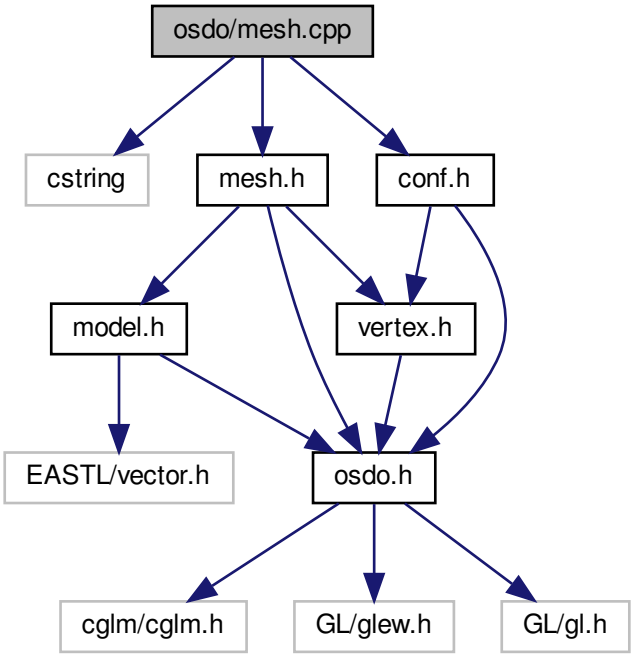
. image.h, 31

8.39 image.h

```
00001 /**
00002  * @file image.h
00003  * @brief  ,  ,  .
00004  */
00005 #ifndef IMAGE_H
00006 #define IMAGE_H
00007 #include <EASTL/shared_ptr.h>
00008
00009 /**
00010  *
00011  *
00012  *  ""  'stb_image.h'.
00013  */
00014 #define COMP 4
00015
00016 using eastl::shared_ptr;
00017
00018 /**
00019  * @brief  .
00020  *  'unsigned char',
00021  *  [0, 255],  8-.
00022  */
00023 typedef unsigned char channel_t;
00024
00025 /**
00026  * @brief  .
00027  *  'COMP'  'channel_t'.
00028  *  8-  ,  [0, 255].
00029  *  4 (, ,  ), 4 .
00030  */
00031 typedef channel_t pixel_t[COMP];
00032
00033 /**
00034  * @brief  ,  .
00035  */
00036 class Image
00037 {
00038 public:
00039     /**
00040      * @brief  .
00041      *
00042      *  *.
00043      */
00044     shared_ptr<const pixel_t[]> data;
00045     /**
00046      * @brief  .
00047      */
00048     const int width;
00049     /**
00050      * @brief  .
00051      */
00052     const int height;
00053
00054     /**
00055      * @brief  .
00056      *  ,
00057      *  .
00058      * @param data  ,
00059      *  ' * '.
00060      * @param width  .
00061      * @param height  .
00062      */
00063     Image(shared_ptr<const pixel_t[]> data,
00064           const int width, const int height);
00065     /**
00066      * @brief  .
00067      * @param path  .
00068      * @return 'Image',  .
00069      */
00070     static Image fromFile(const char *path);
00071 };
00072
00073
00074 #endif // IMAGE_H
```

8.40 osdo/mesh.cpp

#include <cstring>
#include "mesh.h"
#include "conf.h"
mesh.cpp:



8.41 mesh.cpp

```
00001 #include <cstring>
00002 #include "mesh.h"
00003 #include "conf.h"
00004
00005 Mesh::Mesh() : indices_size(0) {
00006     // create buffers/arrays
00007     glGenVertexArrays(1, &this->vao);
00008     glGenBuffers(1, &this->vbo);
00009     glGenBuffers(1, &this->ebo);
00010     glBindVertexArray(this->vao);
00011     glBindBuffer(GL_ARRAY_BUFFER, this->vbo);
00012     glBindBuffer(GL_ELEMENT_ARRAY_BUFFER, this->ebo);
00013
00014     // set the vertex attribute pointers
00015     // vertex Positions
00016     glEnableVertexAttribArray(0);
00017     glVertexAttribPointer(0, 3, GL_FLOAT, GL_FALSE, sizeof(Vertex),
00018                           reinterpret_cast<void*>(offsetof(Vertex, position)));
00019
00020     // vertex normals
00021     glEnableVertexAttribArray(1);
00022     glVertexAttribPointer(1, 3, GL_FLOAT, GL_FALSE, sizeof(Vertex),
00023                           reinterpret_cast<void*>(offsetof(Vertex, normal)));
00024
00025     // vertex color
00026     glEnableVertexAttribArray(2);
00027     glVertexAttribPointer(2, 4, GL_UNSIGNED_BYTE, GL_TRUE, sizeof(Vertex),
00028                           reinterpret_cast<void*>(offsetof(Vertex, color)));
00029
```

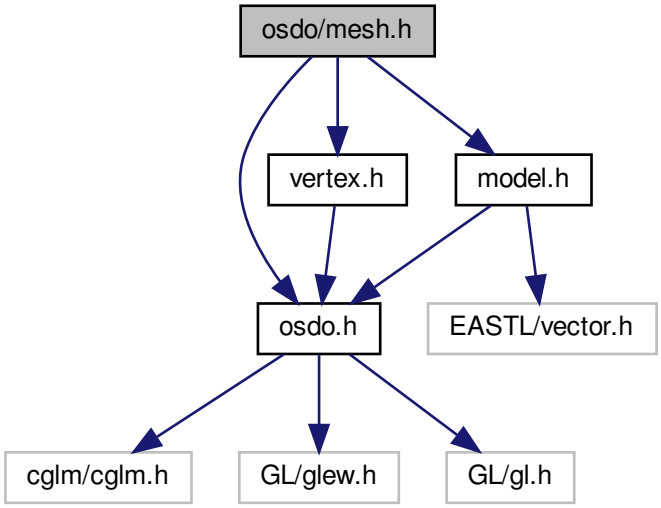
```
00030     // vertex uv
00031     glEnableVertexAttribArray(3);
00032     glVertexAttribPointer(3, 2, GL_FLOAT, GL_FALSE, sizeof(Vertex),
00033                           reinterpret_cast<void*>(offsetof(Vertex, uv)));
00034
00035     glBindBuffer(GL_ARRAY_BUFFER, 0);
00036     glBindBuffer(GL_ELEMENT_ARRAY_BUFFER, 0);
00037     glBindVertexArray(0);
00038 }
00039
00040 Mesh::~Mesh() {
00041     glDeleteVertexArrays(1, &this->vao);
00042     glDeleteBuffers(1, &this->vbo);
00043     glDeleteBuffers(1, &this->ebo);
00044 }
00045
00046 void Mesh::cube_update() {
00047     size_t vert_size = sizeof(EXAMPLE_CUBE_VERTEX) / sizeof(Vertex);
00048     size_t indi_size = sizeof(EXAMPLE_CUBE_INDICIES) / sizeof(GLuint);
00049     update(EXAMPLE_CUBE_VERTEX, vert_size,
00050            EXAMPLE_CUBE_INDICIES, indi_size);
00051 }
00052
00053 void Mesh::update(const Vertex *vertices, size_t vertices_n,
00054                   const GLuint *indices, size_t indices_n) {
00055     if (vertices_n == 0 || indices_n == 0)
00056         return;
00057     indices_size = static_cast<GLint>(indices_n);
00058     glBindVertexArray(this->vao);
00059     // load data into vertex buffers
00060     glBindBuffer(GL_ARRAY_BUFFER, this->vbo);
00061     glBufferData(GL_ARRAY_BUFFER, vertices_n * sizeof(Vertex),
00062                  vertices, GL_STATIC_DRAW);
00063
00064     glBindBuffer(GL_ELEMENT_ARRAY_BUFFER, this->ebo);
00065     glBufferData(GL_ELEMENT_ARRAY_BUFFER, indices_n * sizeof(GLuint),
00066                  indices, GL_STATIC_DRAW);
00067
00068     glBindBuffer(GL_ARRAY_BUFFER, 0);
00069     glBindBuffer(GL_ELEMENT_ARRAY_BUFFER, 0);
00070     glBindVertexArray(0);
00071 }
00072
00073 void Mesh::draw_mode(GLenum mode) {
00074     if (!indices_size)
00075         return;
00076     glBindVertexArray(this->vao);
00077     glBindBuffer(GL_ELEMENT_ARRAY_BUFFER, this->ebo);
00078     glBindBuffer(GL_ARRAY_BUFFER, this->vbo);
00079     glDrawElements(mode, static_cast<GLint>(this->indices_size),
00080                    GL_UNSIGNED_INT, nullptr);
00081
00082     glBindBuffer(GL_ARRAY_BUFFER, 0);
00083     glBindBuffer(GL_ELEMENT_ARRAY_BUFFER, 0);
00084     glBindVertexArray(0);
00085 }
00086
00087 void Mesh::draw(Shader &, bool) {
00088     Mesh::draw_mode(GL_TRIANGLES);
00089 }
```

8.42 osdo/mesh.h

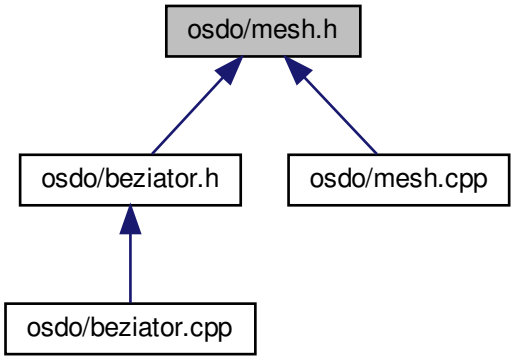
, .

```
#include "osdo.h"
#include "model.h"
#include "vertex.h"
```

mesh.h:



, :



- class Mesh

, .

8.42.1

, .

. mesh.h

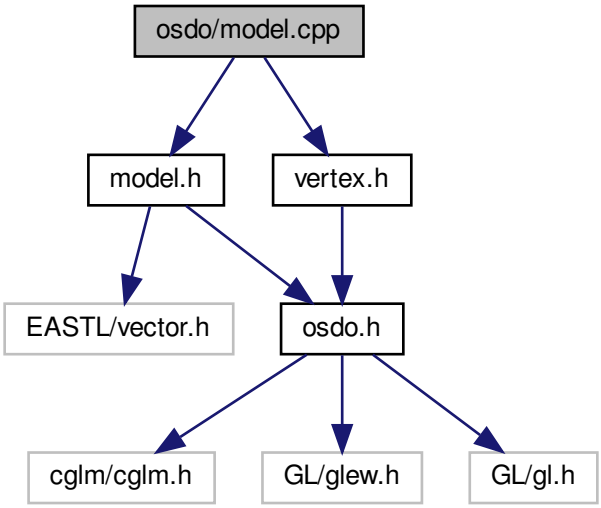
8.43 mesh.h

```
00001 /**
00002  * @file mesh.h
00003  * @brief   ,    .
00004  */
00005 #ifndef MESH_H
00006 #define MESH_H
00007
00008 #include "osdo.h"
00009 #include "model.h"
00010 #include "vertex.h"
00011
00012 /**
00013  * @brief ,    .
00014  */
00015 class Mesh : public Model {
00016 protected:
00017     /**
00018      * @brief   .  "Vertex Array Object".
00019      */
00020     GLuint vao;
00021     /**
00022      * @brief '   .  "Vertex Buffer Object".
00023      */
00024     GLuint vbo;
00025     /**
00026      * @brief '   .  "Element Buffer Objects".
00027      */
00028     GLuint ebo;
00029     /**
00030      * @brief    'ebo'.
00031      */
00032     GLint indices_size;
00033 public:
00034     Mesh();
00035     ~Mesh() override;
00036
00037     Mesh(const Mesh&) = delete;
00038     Mesh(Mesh&&) = delete;
00039     Mesh& operator=(const Mesh&) = delete;
00040     Mesh& operator=(Mesh&&) = delete;
00041
00042     /**
00043      * @brief     .
00044      */
00045     void cube_update();
00046     /**
00047      * @brief     .
00048      * @param vertices
00049      * @param vertices_n
00050      * @param indices
00051      * @param indices_n
00052      */
00053     void update(const Vertex* vertices, size_t vertices_n,
00054                 const GLuint* indices, size_t indices_n);
00055
00056     /**
00057      * @brief  .
00058      * @param shader      .
00059      * @param pre_generated    ,   .
00060      */
00061     void draw(Shader &shader, bool pre_generated) override;
00062     /**
00063      * @brief     .
00064      * . [glDrawElements][glDrawElements].
00065      * [glDrawElements]: https://www.khronos.org/registry/OpenGL-
      Refpages/gl4/html/glDrawElements.xhtml#parameters
00066      * @param mode  .
00067      */
00068     void draw_mode(GLenum mode);
00069 };
00070
00071 #endif
```

8.44 osdo/model.cpp

```
#include "model.h"
#include "vertex.h"
```

model.cpp:



8.45 model.cpp

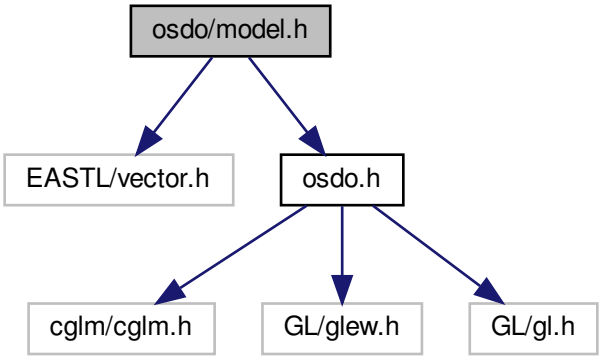
```
00001 #include "model.h"
00002 #include "vertex.h"
00003
00004 Model::~Model() {}
00005
00006 void Model::draw(Shader &, bool pre_generated) {}
00007
00008 void Model::generate(size_t d) {}
00009
00010 vector<Vertex> *Model::get_vertices() {
00011     return nullptr;
00012 }
00013
00014 void Model::edit_panel() {}
```

8.46 osdo/model.h

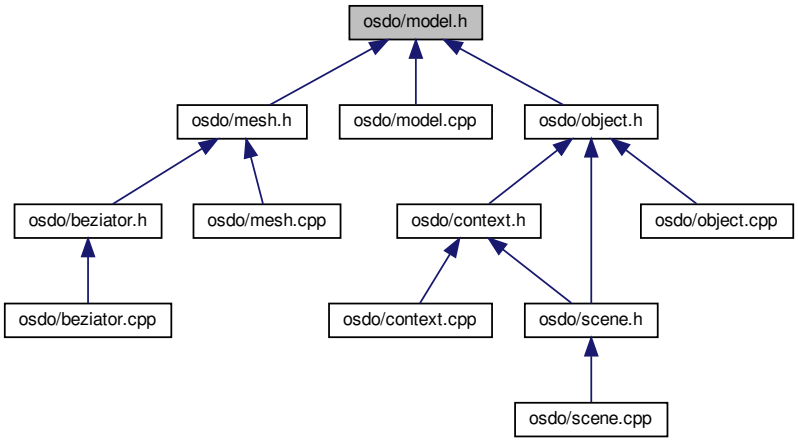
, .

#include <EASTL/vector.h>
#include "osdo.h"

model.h:



, :



- class Model

, .

8.46.1

, .

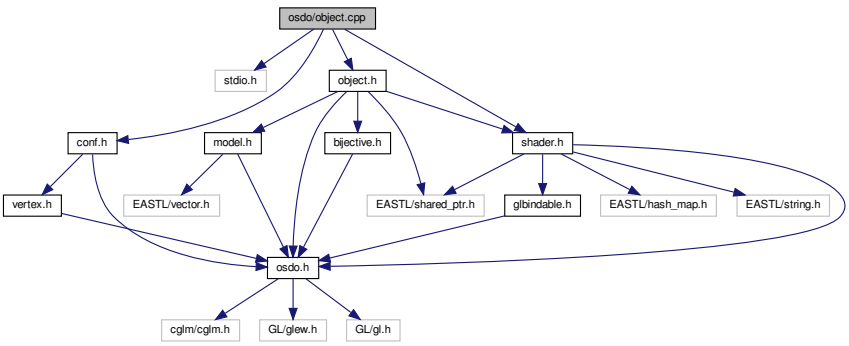
. model.h

8.47 model.h

```
00001 /**
00002  * @file model.h
00003  * @brief   ,   .
00004  */
00005 #ifndef MODEL_H
00006 #define MODEL_H
00007
00008 #include <EASTL/vector.h>
00009 #include "osdo.h"
00010
00011 struct Vertex;
00012 class Shader;
00013 using eastl::vector;
00014
00015 /**
00016  * @brief    ,   .
00017  */
00018 class Model {
00019 public:
00020     virtual ~Model();
00021     /**
00022      * @brief  .
00023      * @param shader      .
00024      * @param pre_generated ,      .
00025      */
00026     virtual void draw(Shader &shader, bool pre_generated = false);
00027     /**
00028      * @brief    .
00029      * . 'Beziator::generate'
00030      * @param d  .
00031      */
00032     virtual void generate(size_t d = 8);
00033     /**
00034      * @brief    .
00035      * @return    'vertices'.
00036      */
00037     virtual vector<Vertex> *get_vertices();
00038     /**
00039      * @brief    .
00040      */
00041     virtual void edit_panel();
00042 };
00043
00044 #endif // MODEL_H
```

8.48 osdo/object.cpp

#include <stdio.h>
#include "object.h"
#include "conf.h"
#include "shader.h"
object.cpp:



8.49 object.cpp

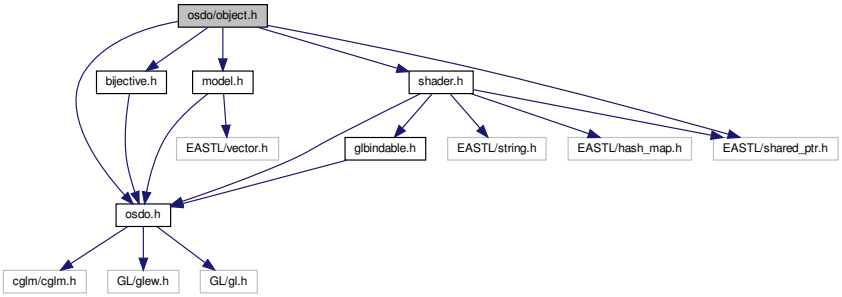
```
00001 #include <stdio.h>
00002
00003 #include "object.h"
00004 #include "conf.h"
00005 #include "shader.h"
00006
00007 Object::Object(shared_ptr<Model> model)
00008     : transform GLM_MAT4_IDENTITY_INIT,
00009       position GLM_VEC4_BLACK_INIT,
00010       animation GLM_VEC3_ZERO_INIT,
00011       model(model)
00012 {
00013 }
00014 void Object::get_position(vec4 position)
00015 {
00016     glm_vec4_copy(this->position, position);
00017 }
00018
00019 void Object::set_position(vec4 position)
00020 {
00021     glm_vec4_copy(position, this->position);
00022 }
00023
00024 void Object::get_rotation(vec3 rotation)
00025 {
00026     glm_euler_angles(this->transform, rotation);
00027 }
00028
00029 void Object::set_rotation(vec3 rotation)
00030 {
00031     glm_euler_xyz(rotation, this->transform);
00032 }
00033
00034 void Object::get_animation(vec3 animation)
00035 {
00036     glm_vec3_copy(this->animation, animation);
00037 }
00038
00039 void Object::set_animation(vec3 animation)
00040 {
00041     glm_vec3_copy(animation, this->animation);
00042 }
00043
00044 void Object::get_mat4(mat4 dest) {
00045     glm_translate_make(dest, this->position);
00046     glm_mat4_mul(dest, this->transform, dest);
00047 }
00048
00049 void Object::translate(vec3 distances, float delta_time) {
00050     vec3 new_distances = GLM_VEC3_ZERO_INIT;
00051     glm_vec3_muladds(distances, OBJECT_MOVE_SPEED * delta_time,
00052                      new_distances);
00053     Object::translate_object( new_distances);
00054 }
00055
00056 void Object::draw(Shader &shader, mat4 mat4buf, GLdouble delta_time,
00057                   bool pre_generated) {
00058     // render the loaded model
00059     Object::animate(static_cast<GLfloat>(delta_time));
00060     Object::get_mat4(mat4buf);
00061     shader.set_mat4("model", mat4buf);
00062     this->model->draw(shader, pre_generated);
00063 }
00064
00065 void Object::rotate(enum coord_enum coord, float delta_time) {
00066     Object::rotate_object(delta_time * OBJECT_ROTATE_SPEED, coord);
00067 }
00068
00069 void Object::rotate_all(vec3 angles) {
00070     Object::rotate_all_object(angles);
00071 }
00072
00073 void Object::add_animation(vec3 angles, float delta_time) {
00074     vec3 animation = GLM_VEC3_ZERO_INIT;
00075     glm_vec3_muladds(angles, delta_time, animation);
00076     glm_vec3_add(this->animation, animation,
00077                  this->animation);
00078 }
00079
00080 shared_ptr<Model> Object::get_model()
00081 {
00082     return model;
00083 }
00084
00085 void Object::translate_object(vec3 distances) {
```

```
00086     glm_vec3_add(this->position, distances, this->position);
00087 }
00088
00089 void Object::rotate_object(float angle, enum coord_enum coord) {
00090     mat4 matrix = GLM_MAT4_IDENTITY_INIT;
00091     switch (coord) {
00092     case X: glm_rotate_x(matrix, angle, matrix); break;
00093     case Y: glm_rotate_y(matrix, angle, matrix); break;
00094     case Z: glm_rotate_z(matrix, angle, matrix); break;
00095     }
00096     glm_mat4_mul(matrix, this->transform, this->transform);
00097 }
00098
00099 void Object::rotate_all_object(vec3 angles) {
00100     Object::rotate_object(angles[0], X);
00101     Object::rotate_object(angles[1], Y);
00102     Object::rotate_object(angles[2], Z);
00103 }
00104
00105 void Object::animate(float step) {
00106     vec3 animation = GLM_VEC3_ZERO_INIT;
00107     glm_vec3_muladds(this->animation, step, animation);
00108     Object::rotate_all(animation);
00109 }
00110
00111 void Object::scale(vec3 scale) {
00112     glm_scale(this->transform, scale);
00113 }
00114
00115 mat4 *Object::get_transform()
00116 {
00117     return &this->transform;
00118 }
```

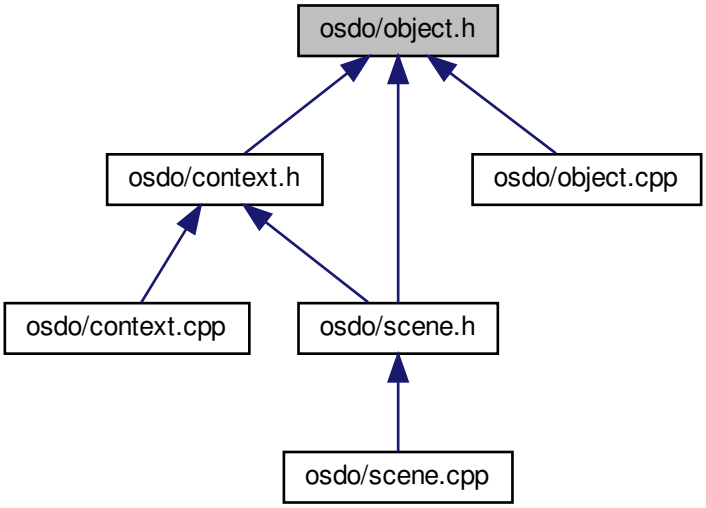
8.50 osdo/object.h

' .

#include "osdo.h"
#include "bijective.h"
#include "model.h"
#include "shader.h"
#include "EASTL/shared_ptr.h"
object.h:



, :



- class Object
  '.

8.50.1

'.

. object.h

8.51 object.h

```
00001 /**
00002  * @file object.h
00003  * @brief  ' .
00004  */
00005 #ifndef OBJECT_H
00006 #define OBJECT_H
00007
00008 #include "osdo.h"
00009
00010 #include "bijective.h"
00011 #include "model.h"
00012 #include "shader.h"
00013 #include "EASTL/shared_ptr.h"
00014 using eastl::shared_ptr;
00015 using eastl::make_shared;
00016
00017 /**
00018  * @brief ' .
00019  */
00020 class Object : public Bijective {
00021     /**
00022      * @brief  .
00023      */
```

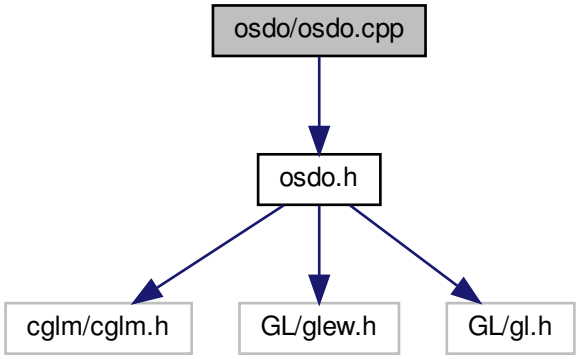
```
00024     mat4 transform;
00025     /**
00026      * @brief  '
00027      */
00028     vec4 position;
00029     /**
00030      * @brief     \f$(x, y, z, 1.0)\f$.
00031      */
00032     vec4 animation;
00033     /**
00034      * @brief  '.
00035      */
00036     shared_ptr<Model> model;
00037
00038 public:
00039     /**
00040      * @brief ,   '  .
00041      * @param model  '.
00042      */
00043     Object(shared_ptr<Model> model = nullptr);
00044     ~Object() override = default;
00045
00046     /**
00047      * @brief    '  .
00048      * @param[out] position   '
00049      */
00050     void get_position(vec4 position) override;
00051     /**
00052      * @brief    '  .
00053      * @param[in] position   '
00054      */
00055     void set_position(vec4 position) override;
00056
00057     /**
00058      * @brief    '.
00059      * @param[out] rotation    '
00060      */
00061     void get_rotation(vec3 rotation) override;
00062     /**
00063      * @brief    '.
00064      * @param[in] rotation   '
00065      */
00066     void set_rotation(vec3 rotation) override;
00067
00068     /**
00069      * @brief     '.
00070      * @param[out] rotation    '
00071      */
00072     void get_animation(vec3 rotation) override;
00073     /**
00074      * @brief     '.
00075      * @param[in] rotation    '.
00076      */
00077     void set_animation(vec3 rotation) override;
00078
00079     /**
00080      * @brief      '.
00081      * @param[out] matrix
00082      */
00083     void get_mat4(mat4 matrix) override;
00084
00085     /**
00086      * @brief  '  .
00087      *
00088      *  '       'distances',
00089      *         .
00090      * @param[in] distances
00091      * @param[in] delta_time
00092      */
00093     void translate(vec3 distances, float delta_time) override;
00094     /**
00095      * @brief  '.
00096      * @param[in] coord
00097      * @param[in] delta_time
00098      */
00099     void rotate(enum coord_enum coord, float delta_time) override;
00100     /**
00101      * @brief  '   .
00102      * @param[in] angles
00103      */
00104     void rotate_all(vec3 angles) override;
00105     /**
00106      * @brief     '.
00107      * @param[in] angles
00108      * @param[in] delta_time
00109      */
00110     void add_animation(vec3 angles, float delta_time) override;
```

```
00111
00112     /**
00113      * @brief   '.
00114      * @return  '
00115      */
00116     shared_ptr<Model> get_model();
00117
00118     /**
00119      * @brief  '
00120      * @param shader
00121      * @param mat4buf
00122      * @param delta_time
00123      * @param pre_generated ,
00124      */
00125     void draw(Shader &shader, mat4 mat4buf, GLdouble delta_time,
00126               bool pre_generated);
00127
00128     /**
00129      * @brief  '    .
00130      * @param distances       \f$(x, y, z)\f$
00131      */
00132     void translate_object(vec3 distances);
00133
00134     /**
00135      * @brief  '     .
00136      * @param angle
00137      * @param coord
00138      */
00139     void rotate_object(float angle, enum coord_enum coord);
00140     /**
00141      * @brief  '      .
00142      * @param angles       \f$(x, y, z)\f$
00143      */
00144     void rotate_all_object(vec3 angles);
00145
00146     /**
00147      * @brief  '    .
00148      * @param step
00149      */
00150     void animate(float step);
00151
00152     /**
00153      * @brief    '    .
00154      * @param scale       \f$(x, y, z)\f$
00155      */
00156     void scale(vec3 scale);
00157     /**
00158      * @brief      .
00159      * @return
00160      */
00161     mat4* get_transform();
00162 };
00163
00164 #endif // OBJECT_H
```

8.52 osdo/osdo.cpp

#include "osdo.h"

osdo.cpp:



- void ∗ operator new[] (size_t size, const char ∗name, int flags, unsigned debugFlags, const char ∗file, int line)

  new EASTL.
- void ∗ operator new[] (size_t size, size_t alignment, size_t alignmentOffset, const char ∗pName, int flags, unsigned debugFlags, const char ∗file, int line)

  new EASTL.

- vec3 BASIS0POS = { 0.0f, 0.0f,-32.0f}

  .

8.52.1

8.52.1.1 operator new[]() [1/2] void∗ operator new[] (
size_t size,
const char ∗ name,
int flags,
unsigned debugFlags,
const char ∗ file,
int line)

new EASTL.

. osdo.cpp, 3

8.52.1.2 operator new[]() [2/2]

void* operator new[] (
size_t size,
size_t alignment,
size_t alignmentOffset,
const char * pName,
int flags,
unsigned debugFlags,
const char * file,
int line)

new EASTL.

. osdo.cpp, 8

8.52.2

8.52.2.1 BASIS0POS

vec3 BASIS0POS = { 0.0f, 0.0f,-32.0f}

.

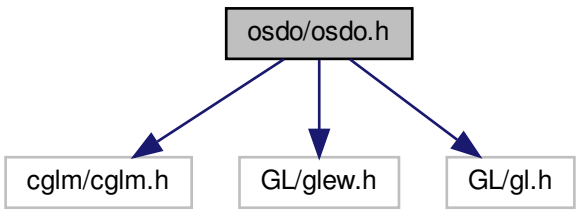
. osdo.cpp, 12

8.53 osdo.cpp

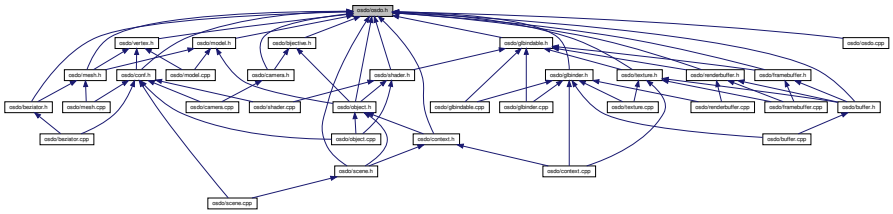
```
00001 #include "osdo.h"
00002
00003 void* operator new[](size_t size, const char* name, int flags, unsigned debugFlags, const char* file, int line)
00004 {
00005     return malloc(size);
00006 }
00007
00008 void* operator new[](size_t size, size_t alignment, size_t alignmentOffset, const char* pName, int flags, unsigned
       debugFlags, const char* file, int line) {
00009     return malloc(size);
00010 }
00011
00012 vec3 BASIS0POS = { 0.0f, 0.0f,-32.0f};
00013 //vec3 BASIS1POS = {-8.0f, 0.0f,  0.0f};
00014 //vec3 BASIS2POS = { 8.0f, 0.0f,  0.0f};
00015
00016 //vec3 BASIS1ROT = { 0.0f, 0.0f,  0.2f};
00017 //vec3 BASIS2ROT = { 0.0f, 0.0f, -0.2f};
```

8.54 osdo/osdo.h

#include <cglm/cglm.h>
#include <GL/glew.h>
#include <GL/gl.h>
osdo.h:



, :



- #define UNUSED

- enum coord_enum { X = 0 , Y = 1 , Z = 2 }

  .

- void * operator new[] (size_t size, const char *name, int flags, unsigned debugFlags, const char *file, int line)

  new EASTL.
- void * operator new[] (size_t size, size_t alignment, size_t alignmentOffset, const char *pName, int flags, unsigned debugFlags, const char *file, int line)

  new EASTL.

- vec3 BASIS0POS

  .

8.54.1

8.54.1.1 UNUSED #define UNUSED

. osdo.h, 25

8.54.2

8.54.2.1 coord_enum enum coord_enum

.

X	X
Y	Y
Z	Z

. osdo.h, 16

8.54.3

8.54.3.1 operator new[]() [1/2] void* operator new[] (
size_t size,
const char * name,
int flags,
unsigned debugFlags,
const char * file,
int line)

new EASTL.

. osdo.cpp, 3

8.54.3.2 operator new[]() [2/2] void* operator new[] (
size_t size,
size_t alignment,
size_t alignmentOffset,
const char * pName,
int flags,
unsigned debugFlags,
const char * file,
int line)

new EASTL.

. osdo.cpp, 8

8.54.4

8.54.4.1 BASIS0POS vec3 BASIS0POS [extern]

.

. osdo.cpp, 12

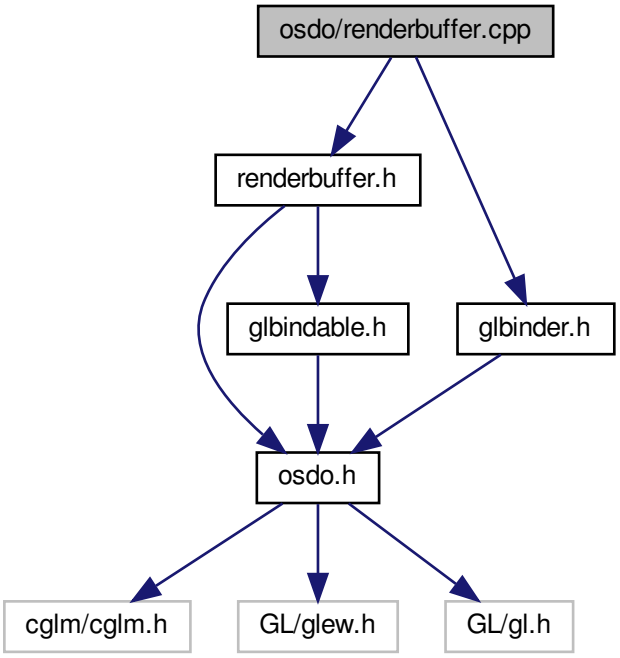
8.55 osdo.h

```
00001 #ifndef OSDO_H
00002 #define OSDO_H
00003
00004 #include <cglm/cglm.h>
00005 #include <GL/glew.h>
00006 #include <GL/gl.h>
00007
00008 /*#define max(a,b) \
00009   ({ __typeof__ (a) _a = (a); \
00010       __typeof__ (b) _b = (b); \
00011     _a > _b ? _a : _b; })*/
00012
00013 /**
00014  * @brief  .
00015  */
00016 enum coord_enum {
00017     X = 0, /**<  X */
00018     Y = 1, /**<  Y */
00019     Z = 2, /**<  Z */
00020 };
00021
00022 #ifdef __GNUC__
00023 #define UNUSED __attribute__ ((unused))
00024 #else
00025 #define UNUSED
00026 #endif
00027
00028 /**
00029  * @brief  `new`  EASTL
00030  */
00031 void* operator new[](size_t size, const char* name, int flags,
00032 unsigned debugFlags, const char* file, int line);
00033
00034 /**
00035  * @brief  `new`  EASTL
00036  */
00037 void* operator new[](size_t size, size_t alignment, size_t alignmentOffset,
00038 const char* pName, int flags, unsigned debugFlags, const char* file, int line);
00039
00040 /**
00041  * @brief  .
00042  */
00043 extern vec3 BASIS0POS;
00044 //extern vec3 BASIS1POS;
00045 //extern vec3 BASIS2POS;
00046
00047 //extern vec3 BASIS1ROT;
00048 //extern vec3 BASIS2ROT;
00049
00050 #endif // OSDO_H
```

8.56 osdo/renderbuffer.cpp

```
#include "renderbuffer.h"
#include "glbinder.h"
```

renderbuffer.cpp:



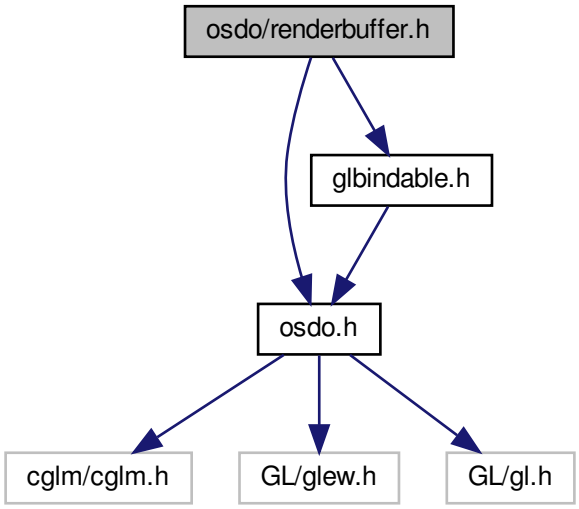
8.57 renderbuffer.cpp

```
00001 #include "renderbuffer.h"
00002 #include "glbinder.h"
00003
00004 GLuint Renderbuffer::_generate() const
00005 {
00006     GLuint id;
00007     glGenRenderbuffers(1, &id);
00008     return id;
00009 }
00010
00011 void Renderbuffer::_bind(const GLuint id, GLenum target) const
00012 {
00013     glBindRenderbuffer(target, id);
00014 }
00015
00016 GLenum Renderbuffer::_default() const
00017 {
00018     return GL_RENDERBUFFER;
00019 }
00020
00021 Renderbuffer::~Renderbuffer() {
00022     glDeleteRenderbuffers(1, &get_id());
00023 }
00024
00025 void Renderbuffer::make_multisample(GLsizei size[2], GLenum target) const {
00026     GlBinder b = binder();
00027     glRenderbufferStorageMultisample(
00028                 GL_RENDERBUFFER, 4, target, size[0], size[1]);
00029 }
00030
00031 void Renderbuffer::make(GLsizei size[2], GLenum target) const
00032 {
00033     GlBinder b = binder();
00034     glRenderbufferStorage(GL_RENDERBUFFER, target, size[0], size[1]);
00035
00036 }
```

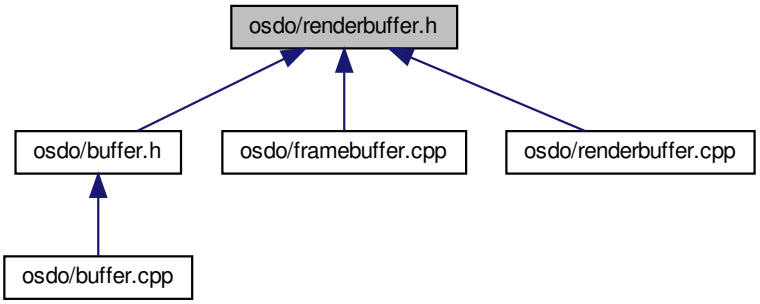
8.58 osdo/renderbuffer.h

( ).

#include "osdo.h"
#include "glbindable.h"
renderbuffer.h:



, :



- class Renderbuffer
  ( )

8.58.1

( ).

. renderbuffer.h

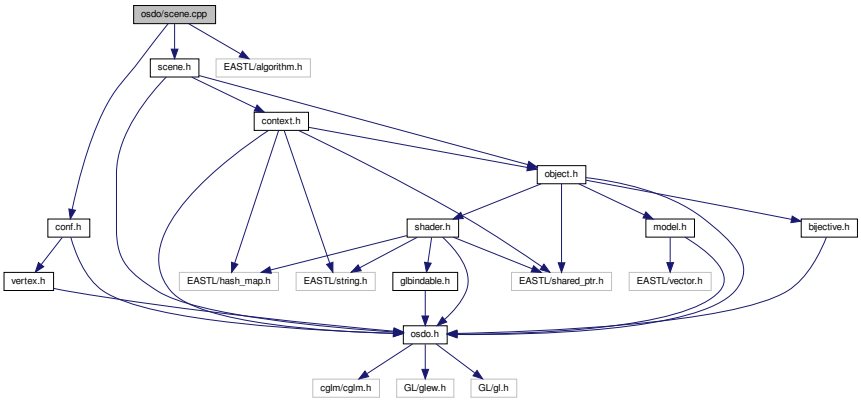
8.59 renderbuffer.h

```
00001 /**
00002  * @file renderbuffer.h
00003  * @brief     (    ).
00004  */
00005 #ifndef RENDERBUFFER_H
00006 #define RENDERBUFFER_H
00007
00008 #include "osdo.h"
00009 #include "glbindable.h"
00010
00011 /**
00012  * @brief   (    )
00013  */
00014 class Renderbuffer : public GlBindable
00015 {
00016     /**
00017      * @brief      .
00018      * @return
00019      */
00020     GLuint _generate() const override;
00021     /**
00022      * @brief  ,  '  OpenGL    .
00023      * @param id
00024      * @param target  '
00025      */
00026     virtual void _bind(const GLuint id, GLenum target) const override;
00027     /**
00028      * @brief  ,    '  .
00029      * @return  '
00030      */
00031     virtual GLenum _default() const override;
00032 public:
00033     /**
00034      * @brief ,    .
00035      */
00036     Renderbuffer() : GlBindable(_generate()) {}
00037     ~Renderbuffer() override;
00038
00039     /**
00040      * @brief     .
00041      * @param size
00042      * @param target
00043      */
00044     void make_multisample(GLsizei size[2], GLenum target) const;
00045
00046     /**
00047      * @brief    .
00048      * @param size
00049      * @param target
00050      */
00051     void make(GLsizei size[2], GLenum target) const;
00052 };
00053
00054 #endif // RENDERBUFFER_H
```

8.60 osdo/scene.cpp

#include "scene.h"
#include "conf.h"

#include "EASTL/algorithm.h"
scene.cpp:



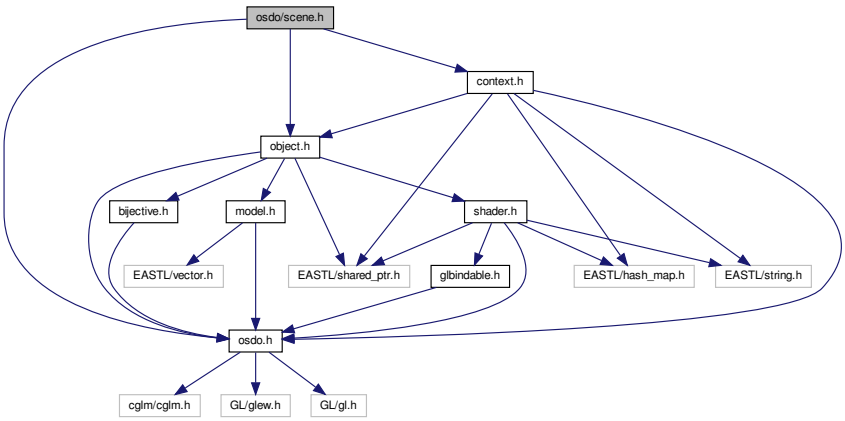
8.61 scene.cpp

```
00001 #include "scene.h"
00002 #include "conf.h"
00003 #include "EASTL/algorithm.h"
00004 using eastl::transform;
00005 using eastl::make_shared;
00006
00007 Scene::Scene(const Context::Models &objects) : objects(objects) {
00008 }
00009
00010 shared_ptr<Scene> Scene::create(const Context::Models &objects)
00011 {
00012     return make_shared<Scene>(objects);
00013 }
```

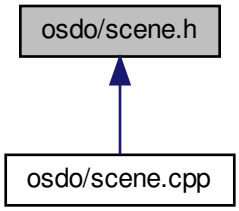
8.62 osdo/scene.h

'.

#include "osdo.h"
#include "object.h"
#include "context.h"
scene.h:



, :



- struct Scene
  '.

8.62.1

'.

. scene.h

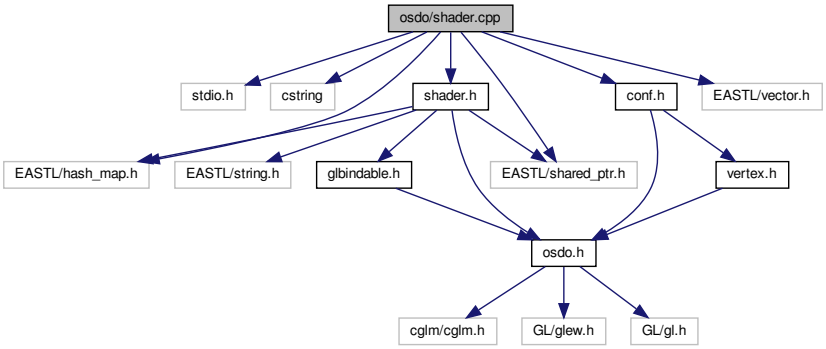
8.63 scene.h

```
00001 /**
00002  * @file scene.h
00003  * @brief     '.
00004  */
00005 #ifndef SCENE_H
00006 #define SCENE_H
00007
00008 #include "osdo.h"
00009
00010 #include "object.h"
00011 #include "context.h"
00012
00013 /**
00014  * @brief   '.
00015  */
00016 struct Scene {
00017     /**
00018      * @brief '  .
00019      */
00020     hash_map<string, Object> objects;
00021
00022     /**
00023      * @brief ,   '       'objects'
00024      * @param objects  '
00025      */
00026     Scene(const Context::Models& objects);
00027
00028     /**
00029      * @brief
00030      * @param objects  '
00031      * @return     ' .
00032      */
00033     static shared_ptr<Scene> create(const Context::Models& objects);
00034 };
00035
00036 #endif // SCENE_H
```

8.64 osdo/shader.cpp

```
#include <stdio.h>
#include <cstring>
#include "shader.h"
#include "conf.h"
#include "EASTL/hash_map.h"
#include "EASTL/shared_ptr.h"
#include "EASTL/vector.h"
```

shader.cpp:



- class ShaderSource

- char * readFromFile (const char *path)
- bool check_shader (GLuint shader, const int type)
- shared_ptr< Shader > compile (vector< shared_ptr< ShaderSource >> shaders)

8.64.1

8.64.1.1 check_shader()

bool check_shader (
GLuint shader,
const int type)

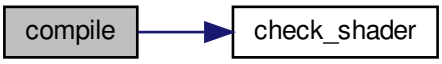
. shader.cpp, 40

:

8.64.1.2 compile() shared_ptr<Shader> compile (vector< shared_ptr< ShaderSource >> shaders)

. shader.cpp, 95

:



8.64.1.3 readFromFile() char* readFromFile (const char * path)

. shader.cpp, 21

:

8.65 shader.cpp

```
00001 #include <stdio.h>
00002 #include <cstring>
00003
00004 #include "shader.h"
00005 #include "conf.h"
00006 #include "EASTL/hash_map.h"
00007 #include "EASTL/shared_ptr.h"
00008 #include "EASTL/vector.h"
00009 using eastl::hash_map;
00010 using eastl::make_shared;
00011 using eastl::vector;
00012
00013 static hash_map<ShaderType, GLenum> TYPES_MAP = {
00014     {VERT_SHADER, GL_VERTEX_SHADER},
00015     {TESC_SHADER, GL_TESS_CONTROL_SHADER},
00016     {TESE_SHADER, GL_TESS_EVALUATION_SHADER},
00017     {GEOM_SHADER, GL_GEOMETRY_SHADER},
00018     {FRAG_SHADER, GL_FRAGMENT_SHADER},
00019 };
00020
00021 char * readFromFile(const char *path) {
00022     char* data;
00023     size_t size;
00024     FILE *file = fopen(path, "r");
00025     if (file == nullptr) {
00026         printf("ERROR: failed to open file %s\n", path);
00027         return nullptr;
00028     }
00029     fseek(file, 0L, SEEK_END);
00030     size = static_cast<size_t>(ftell(file));
00031     fseek(file, 0L, SEEK_SET);
```

```
00032     data = static_cast<char*>(malloc(size + 1));
00033     fread(data, 1, size, file);
00034     data[size] = 0;
00035     fclose(file);
00036     return data;
00037 }
00038
00039 // utility function for checking shader compilation/linking errors.
00040 bool check_shader(GLuint shader, const int type) {
00041     GLint status = 0, size = 0;
00042     GLchar *log;
00043     GLuint status_type = GL_COMPILE_STATUS;
00044     void (*gl_get)(GLuint, GLuint, GLint*) = glGetShaderiv;
00045     void (*gl_info)(GLuint, GLint, GLint*, GLchar*) = glGetShaderInfoLog;
00046
00047     if (type == 0) {
00048         gl_get = glGetProgramiv;
00049         status_type = GL_LINK_STATUS;
00050         gl_info = glGetProgramInfoLog;
00051     }
00052
00053     gl_get(shader, status_type, &status);
00054     if (status == GL_FALSE) {
00055         gl_get(shader, GL_INFO_LOG_LENGTH, &size);
00056         log = static_cast<GLchar*>(malloc(static_cast<size_t>(size)));
00057         if (log == nullptr) {
00058             printf("Got some error, but cant allocate memory to read it.\n");
00059             return false;
00060         }
00061         gl_info(shader, size, &size, log);
00062         puts(log);
00063         fflush(stdout);
00064         free(log);
00065         return false;
00066     }
00067     return true;
00068 }
00069
00070 class ShaderSource {
00071     const GLuint id;
00072 public:
00073     ShaderSource(const GLuint id) : id(id) {}
00074     static shared_ptr<ShaderSource> create(GLenum type, const char *code) {
00075         const GLuint shader = glCreateShader(type);
00076         glShaderSource(shader, 1, &code, nullptr);
00077         glCompileShader(shader);
00078         if (!check_shader(shader, 1)) {
00079             return {};
00080         }
00081         return make_shared<ShaderSource>(shader);
00082     }
00083     static shared_ptr<ShaderSource> create_file(GLenum type, const string& path) {
00084         GLchar* code = readFromFile(path.c_str());
00085         if (!code)
00086             return {};
00087         return create(type, code);
00088     }
00089     GLuint get_id() {return id;}
00090     void attach(const GLuint program) {
00091         glAttachShader(program, id);
00092     }
00093 };
00094
00095 shared_ptr<Shader> compile(vector<shared_ptr<ShaderSource» shaders) {
00096     for (auto &i : shaders) {
00097         if (!i)
00098             return {};
00099     }
00100
00101     GLuint sh = glCreateProgram();
00102     for (auto &i : shaders) {
00103         i->attach(sh);
00104     }
00105     glLinkProgram(sh);
00106     if (!check_shader(sh, 0)) {
00107         return {};
00108     }
00109
00110     return make_shared<Shader>(sh);
00111 }
00112
00113 void Shader::_bind(const GLuint id, UNUSED GLenum target) const
00114 {
00115     glUseProgram(id);
00116 }
00117
00118 Shader::Shader(const GLuint shader) : GlBindable(shader) {}
```

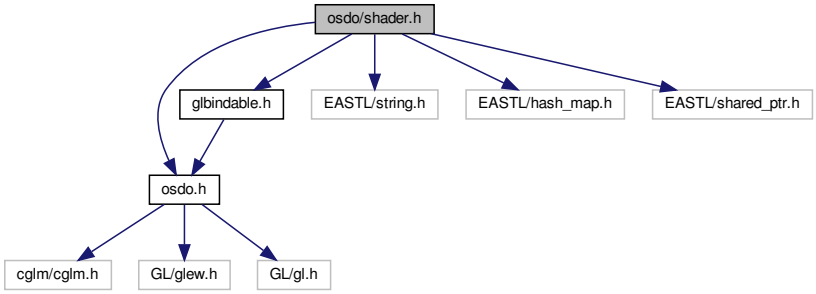
```
00119
00120 Shader::~Shader() {
00121     glDeleteProgram(this->get_id());
00122 }
00123
00124 shared_ptr<Shader> Shader::create(const Shader::shader_map& shaders_paths)
00125 {
00126     vector<shared_ptr<ShaderSource» shaders;
00127     for (auto& i : shaders_paths) {
00128         shaders.push_back(
00129                 ShaderSource::create_file(TYPES_MAP[i.first], i.second));
00130     }
00131     return compile(shaders);
00132 }
00133
00134 void Shader::set_bool(const char* name, bool value) {
00135     glUniform1i(glGetUniformLocation(this->get_id(), name), static_cast<int>(value));
00136 }
00137
00138 void Shader::set_int(const char* name, int value) {
00139     glUniform1i(glGetUniformLocation(this->get_id(), name), value);
00140 }
00141
00142 void Shader::set_float(const char* name, float value) {
00143     glUniform1f(glGetUniformLocation(this->get_id(), name), value);
00144 }
00145
00146 void Shader::set_vec2(const char* name, vec2 value) {
00147     glUniform2fv(glGetUniformLocation(this->get_id(), name),
00148                 1, &value[0]);
00149 }
00150
00151 void Shader::set_vec2f(const char* name,
00152                     float x, float y) {
00153     glUniform2f(glGetUniformLocation(this->get_id(), name), x, y);
00154 }
00155
00156 void Shader::set_vec3(const char* name, vec3 value) {
00157     glUniform3fv(glGetUniformLocation(this->get_id(), name),
00158                 1, &value[0]);
00159 }
00160
00161 void Shader::set_vec3f(const char* name,
00162                     float x, float y, float z) {
00163     glUniform3f(glGetUniformLocation(this->get_id(), name), x, y, z);
00164 }
00165
00166 void Shader::set_vec4(const char* name, vec4 value) {
00167     glUniform4fv(glGetUniformLocation(this->get_id(), name),
00168                 1, &value[0]);
00169 }
00170
00171 void Shader::set_vec4f(const char* name,
00172                     float x, float y, float z, float w) {
00173     glUniform4f(glGetUniformLocation(this->get_id(), name), x, y, z, w);
00174 }
00175
00176 void Shader::set_mat2(const char* name, mat2 mat) {
00177     glUniformMatrix2fv(glGetUniformLocation(this->get_id(), name),
00178                     1, GL_FALSE, &mat[0][0]);
00179 }
00180
00181 void Shader::set_mat3(const char* name, mat3 mat) {
00182     glUniformMatrix3fv(glGetUniformLocation(this->get_id(), name),
00183                     1, GL_FALSE, &mat[0][0]);
00184 }
00185
00186 void Shader::set_mat4(const char* name, mat4 mat) {
00187     glUniformMatrix4fv(glGetUniformLocation(this->get_id(), name),
00188                     1, GL_FALSE, &mat[0][0]);
00189 }
```

8.66 osdo/shader.h

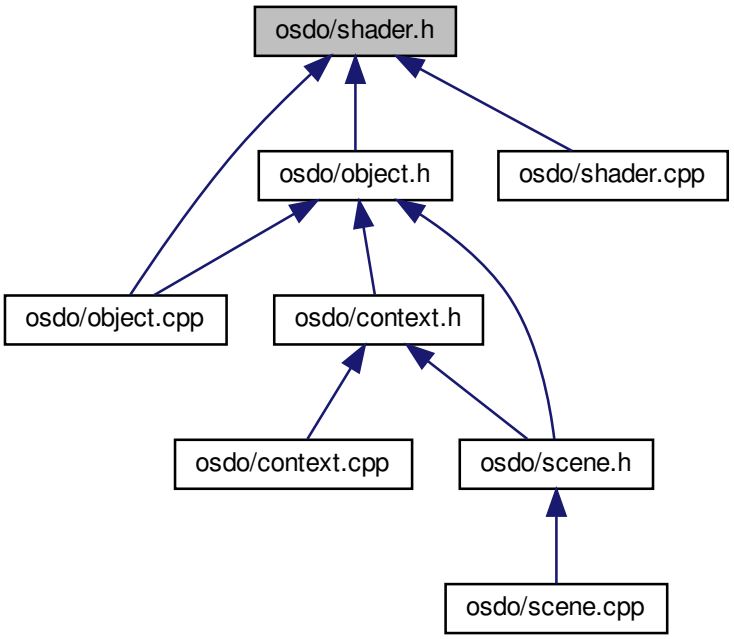
.

```
#include "osdo.h"
#include "glbindable.h"
#include "EASTL/string.h"
#include "EASTL/hash_map.h"
```

#include "EASTL/shared_ptr.h"
shader.h:



, :



- class Shader

.

- enum ShaderType {
  VERT_SHADER , TESC_SHADER , TESE_SHADER , GEOM_SHADER ,
  FRAG_SHADER }

8.66.1

.

. shader.h

8.66.2

8.66.2.1 ShaderType enum ShaderType

VERT_SHADER	
TESC_SHADER	
TESE_SHADER	
GEOM_SHADER	
FRAG_SHADER	

. shader.h, 20

8.67 shader.h

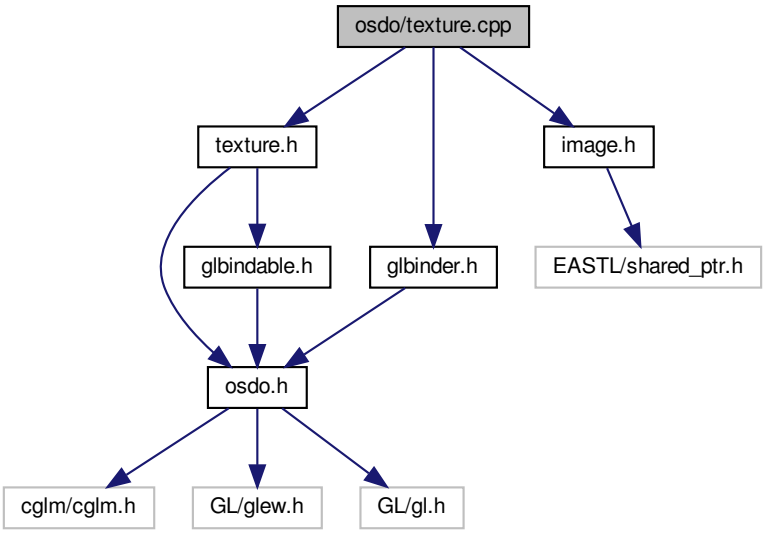
```
00001 /**
00002  * @file shader.h
00003  * @brief   .
00004  */
00005 #ifndef SHADER_H
00006 #define SHADER_H
00007
00008 #include "osdo.h"
00009 #include "glbindable.h"
00010 #include "EASTL/string.h"
00011 #include "EASTL/hash_map.h"
00012 #include "EASTL/shared_ptr.h"
00013 using eastl::string;
00014 using eastl::hash_map;
00015 using eastl::shared_ptr;
00016
00017 /**
00018  * @brief
00019  */
00020 enum ShaderType {
00021     VERT_SHADER, /**<   */
00022     TESC_SHADER, /**<   */
00023     TESE_SHADER, /**<   */
00024     GEOM_SHADER, /**<   */
00025     FRAG_SHADER, /**<   */
00026 };
```

```
00027
00028 /**
00029  * @brief      .
00030  */
00031 class Shader : public GlBindable {
00032     /**
00033      * @brief  ,  '  OpenGL  .
00034      * @param id   OpenGL
00035      * @param target  ,    'GlBindable::_bind'
00036      */
00037     virtual void  _bind(const GLuint id, GLenum target) const override;
00038 public:
00039     /**
00040      * @brief          .
00041      */
00042     typedef hash_map<ShaderType, string> shader_map;
00043     Shader(const GLuint shader);
00044     ~Shader() override;
00045
00046     /**
00047      * @brief  '      .
00048      * @param shaders_paths
00049      * @return    '
00050      */
00051     static shared_ptr<Shader> create(const shader_map& shaders_paths);
00052
00053     /**
00054      * @brief     'bool'
00055      * @param name '
00056      * @param value
00057      */
00058     void set_bool (const char* name, bool value);
00059     /**
00060      * @brief     'int'
00061      * @param name '
00062      * @param value
00063      */
00064     void set_int  (const char* name, int value);
00065     /**
00066      * @brief     'float'
00067      * @param name '
00068      * @param value
00069      */
00070     void set_float(const char* name, float value);
00071     /**
00072      * @brief     'vec2'
00073      * @param name '
00074      * @param value
00075      */
00076     void set_vec2 (const char* name, vec2 value);
00077     /**
00078      * @brief  -   'vec2'
00079      * @param name '
00080      * @param x    -
00081      * @param y    -
00082      */
00083     void set_vec2f(const char* name, float x, float y);
00084     /**
00085      * @brief     'vec3'
00086      * @param name '
00087      * @param value
00088      */
00089     void set_vec3 (const char* name, vec3 value);
00090     /**
00091      * @brief  -   'vec3'
00092      * @param name '
00093      * @param x    -
00094      * @param y    -
00095      * @param z    -
00096      */
00097     void set_vec3f(const char* name, float x, float y, float z);
00098     /**
00099      * @brief     'vec4'
00100      * @param name '
00101      * @param value
00102      */
00103     void set_vec4 (const char* name, vec4 value);
00104     /**
00105      * @brief  -   'vec4'
00106      * @param name '
00107      * @param x    -
00108      * @param y    -
00109      * @param z    -
00110      * @param w    -
00111      */
00112     void set_vec4f(const char* name, float x, float y, float z, float w);
00113     /**
```

```
00114     * @brief     'mat2'
00115     * @param name '
00116     * @param mat
00117     */
00118    void set_mat2 (const char* name, mat2 mat);
00119    /**
00120     * @brief     'mat3'
00121     * @param name '
00122     * @param mat
00123     */
00124    void set_mat3 (const char* name, mat3 mat);
00125    /**
00126     * @brief     'mat4'
00127     * @param name '
00128     * @param mat
00129     */
00130    void set_mat4 (const char* name, mat4 mat);
00131 };
00132
00133 #endif // SHADER_H
```

8.68 osdo/texture.cpp

#include "texture.h"
#include "glbinder.h"
#include "image.h"
texture.cpp:



- void LoadTextureFromFile (const pixel_t(*data)[], int width, int height, const GLuint id)

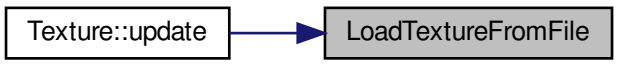
8.68.1

8.68.1.1 LoadTextureFromFile()

```
void LoadTextureFromFile (
        const pixel_t(*) data[],
        int width,
        int height,
        const GLuint id )
```

. texture.cpp, 26

:



8.69 texture.cpp

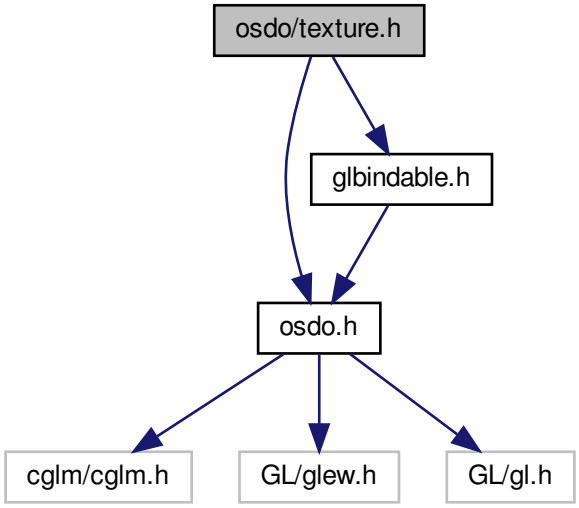
```
00001 #include "texture.h"
00002 #include "glbinder.h"
00003 #include "image.h"
00004
00005 GLuint Texture::_generate() const
00006 {
00007     GLuint id;
00008     glGenTextures(1, &id);
00009     return id;
00010 }
00011
00012 void Texture::_bind(const GLuint id, GLenum target) const
00013 {
00014     glBindTexture(target, id);
00015 }
00016
00017 GLenum Texture::_default() const
00018 {
00019     return GL_TEXTURE_2D_MULTISAMPLE;
00020 }
00021
00022 Texture::~Texture() {
00023     glDeleteTextures(1, &get_id());
00024 }
00025
00026 void LoadTextureFromFile(const pixel_t (*data)[], int width, int height,
00027                          const GLuint id)
00028 {
00029     glBindTexture(GL_TEXTURE_2D, id);
00030
00031     glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_MIN_FILTER, GL_LINEAR);
00032     glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_MAG_FILTER, GL_LINEAR);
00033     glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_WRAP_S, GL_CLAMP_TO_EDGE);
00034     glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_WRAP_T, GL_CLAMP_TO_EDGE);
00035
00036 #if defined(GL_UNPACK_ROW_LENGTH) && !defined(__EMSCRIPTEN__)
00037     glPixelStorei(GL_UNPACK_ROW_LENGTH, 0);
00038 #endif
00039     glTexImage2D(GL_TEXTURE_2D, 0, GL_RGBA, width, height, 0, GL_RGBA,
00040                  GL_UNSIGNED_BYTE, data);
00041 }
00042
00043 void Texture::update(const Image &image) const {
00044     LoadTextureFromFile(image.data.get(), image.width, image.height, get_id());
00045 }
00046
00047 void Texture::make_2d_multisample(GLsizei size[]) const {
00048     GlBinder b = binder(GL_TEXTURE_2D_MULTISAMPLE);
00049     glTexImage2DMultisample(GL_TEXTURE_2D_MULTISAMPLE, 4, GL_RGB,
00050                             size[0], size[1], GL_TRUE);
00051 }
00052
00053 void Texture::make_2d(GLsizei size[]) const {
```

```
00054     GlBinder b = binder(GL_TEXTURE_2D);
00055     glTexImage2D(GL_TEXTURE_2D, 0, GL_RGB, size[0], size[1], 0, GL_RGB,
00056             GL_UNSIGNED_BYTE, nullptr);
00057     glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_MIN_FILTER, GL_NEAREST);
00058     glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_MAG_FILTER, GL_NEAREST);
00059 }
```

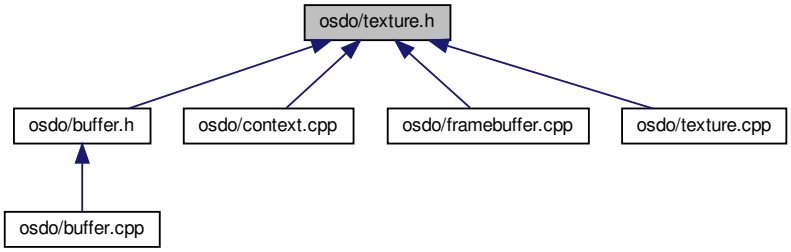
8.70 osdo/texture.h

.

#include "osdo.h"
#include "glbindable.h"
texture.h:



, :



- class Texture

  , .

8.70.1

.

. texture.h

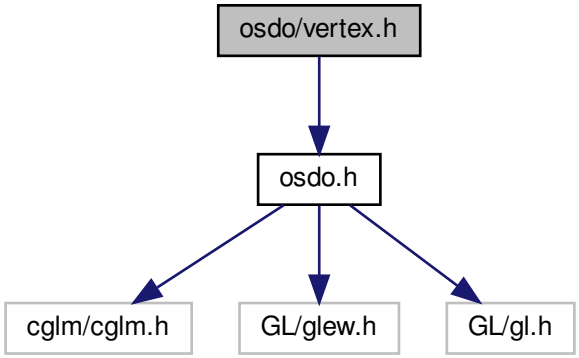
8.71 texture.h

```
00001 /**
00002  * @file texture.h
00003  * @brief  .
00004  */
00005 #ifndef TEXTURE_H
00006 #define TEXTURE_H
00007
00008 #include "osdo.h"
00009 #include "glbindable.h"
00010
00011 class Image;
00012
00013 /**
00014  * @brief  ,  .
00015  */
00016 class Texture : public GlBindable
00017 {
00018     /**
00019      * @brief  .
00020      * @return
00021      */
00022     GLuint _generate() const override;
00023     /**
00024      * @brief  , ' OpenGL  .
00025      * @param id
00026      * @param target  '
00027      */
00028     virtual void _bind(const GLuint id, GLenum target) const override;
00029     /**
00030      * @brief  ,  ' .
00031      * @return  '
00032      */
00033     virtual GLenum _default() const override;
00034 public:
00035     Texture() : GlBindable(_generate()) {}
00036     ~Texture() override;
00037
00038     /**
00039      * @brief  .
00040      * @param image
00041      */
00042     void update(const Image& image) const;
00043
00044     /**
00045      * @brief  .
00046      * @param size
00047      */
00048     void make_2d_multisample(GLsizei size[2]) const;
00049
00050     /**
00051      * @brief  .
00052      * @param size
00053      */
00054     void make_2d(GLsizei size[2]) const;
00055 };
00056
00057 #endif // TEXTURE_H
```

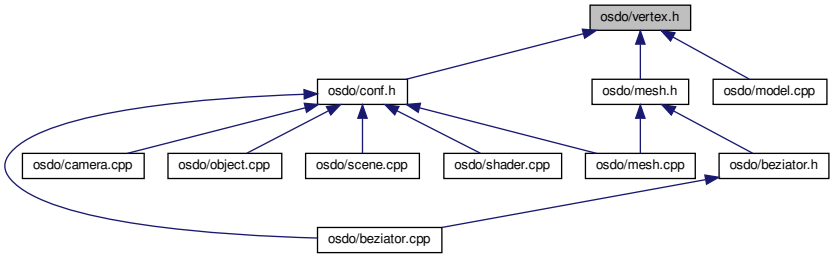
8.72 osdo/vertex.h

c .

#include "osdo.h"
vertex.h:



, :



- struct Vertex

, .

8.72.1

c .

. vertex.h

8.73 vertex.h

```
00001 /**
00002  * @file vertex.h
00003  * @brief  c .
00004  */
00005 #ifndef VERTEX_H
00006 #define VERTEX_H
00007 #include "osdo.h"
00008
00009 /**
00010  * @brief  ,    .
00011  */
00012 struct Vertex {
00013     /**
00014      * @brief    .
00015      */
00016     vec4 position;
00017     /**
00018      * @brief  .
00019      */
00020     vec3 normal;
00021     /**
00022      * @brief  .
00023      */
00024     unsigned char color[4];
00025     /**
00026      * @brief    .
00027      */
00028     vec2 uv;
00029 };
00030
00031 #endif // VERTEX_H
```

8.74 res/bezier.frag

8.75 bezier.frag

```
00001 #version 420 core
00002 layout(location = 0) out vec4 FragColor;
00003
00004 struct Data {
00005     vec4 color;
00006     vec2 uv;
00007     vec3 normal;
00008     vec3 frag_pos;
00009 };
00010
00011 layout(location = 0) in Data data;
00012
00013 struct DirLight {
00014     vec3 direction;
00015
00016     vec3 ambient;
00017     vec3 diffuse;
00018     vec3 specular;
00019 };
00020
00021 uniform vec3 viewPos;
00022 uniform DirLight dirLight;
00023 uniform float materialShininess;
00024 uniform float alpha;
00025 uniform bool textured;
00026 uniform sampler2D textureSample;
00027
00028 // calculates the color when using a directional light.
00029 vec3 CalcDirLight(DirLight light, vec3 normal, vec3 viewDir, vec3 color)
00030 {
00031     vec3 lightDir = normalize(-light.direction);
00032     // diffuse shading
00033     float diff = max(dot(normal, lightDir), 0.0);
00034     // specular shading
00035     vec3 reflectDir = reflect(-lightDir, normal);
00036     float spec = pow(max(dot(viewDir, reflectDir), 0.0), materialShininess);
00037     // combine results
00038     vec3 ambient = light.ambient * color;
00039     vec3 diffuse = light.diffuse * diff * color;
00040     vec3 specular = light.specular * spec * color;
00041     return (ambient + diffuse + specular);
00042 }
00043
00044 void main()
00045 {
```

```
00046     vec3 norm = normalize(data.normal);
00047     vec3 viewDir = normalize(-viewPos - data.frag_pos);
00048     vec4 color = data.color;
00049     if (textured) {
00050         color = texture(textureSample, data.uv);
00051     }
00052     vec3 tmp = CalcDirLight(dirLight, norm, viewDir, vec3(color));
00053     FragColor = vec4(tmp, alpha);
00054 }
```

8.76 res/bezier.geom

8.77 bezier.geom

```
00001 #version 420 core
00002 layout(triangles) in;
00003 layout(triangle_strip, max_vertices=16) out;
00004
00005 struct Data {
00006     vec4 color;
00007     vec2 uv;
00008     vec3 normal;
00009     vec3 frag_pos;
00010 };
00011
00012 in Data vertex[3];
00013 out Data geometry;
00014
00015 void main() {
00016     int i;
00017     for(i = 0; i < 16; i++) {
00018         gl_Position = gl_in[i].gl_Position;
00019         geometry.color = vertex[i].color;
00020         geometry.uv = vertex[i].uv;
00021         geometry.pos = vertex[i].pos;
00022         geometry.normal = vertex[i].normal;
00023         EmitVertex();
00024     }
00025     EndPrimitive();
00026 }
```

8.78 res/bezier.tesc

8.79 bezier.tesc

```
00001 #version 420 core
00002
00003 struct Data {
00004     vec4 color;
00005     vec2 uv;
00006     vec3 normal;
00007     vec3 frag_pos;
00008 };
00009
00010 layout(location = 0) in Data inData[];
00011 layout(location = 0) out Data outData[];
00012
00013 uniform int inner;
00014 uniform int outer;
00015
00016 layout(vertices = 16) out;
00017
00018 void main(void) {
00019     gl_TessLevelInner[0] = inner;
00020     gl_TessLevelInner[1] = inner;
00021     gl_TessLevelOuter[0] = outer;
00022     gl_TessLevelOuter[1] = outer;
00023     gl_TessLevelOuter[2] = outer;
00024     gl_TessLevelOuter[3] = outer;
00025
00026     gl_out[gl_InvocationID].gl_Position = gl_in[gl_InvocationID].gl_Position;
00027     outData[gl_InvocationID].color = inData[gl_InvocationID].color;
00028     outData[gl_InvocationID].uv = inData[gl_InvocationID].uv;
00029     outData[gl_InvocationID].normal = inData[gl_InvocationID].normal;
00030     outData[gl_InvocationID].frag_pos = inData[gl_InvocationID].frag_pos;
00031 }
```

8.80 res/bezier.tese

8.81 bezier.tese

```
00001 #version 420 core
00002
00003 layout(quads, equal_spacing) in;
00004
00005 struct Data {
00006     vec4 color;
00007     vec2 uv;
00008     vec3 normal;
00009     vec3 frag_pos;
00010 };
00011
00012 layout(location = 0) in Data inData[];
00013 layout(location = 0) out Data outData;
00014
00015 mat4  b = mat4 ( 1,  0,  0, 0,
00016                 -3,  3,  0, 0,
00017                  3, -6,  3, 0,
00018                 -1,  3, -3, 1);
00019
00020 void main(void) {
00021     float x = gl_TessCoord.x;
00022     float y = gl_TessCoord.y;
00023     vec4 u = vec4 (1.0, x, x*x, x*x*x);
00024     vec4 v = vec4 (1.0, y, y*y, y*y*y);
00025     vec4 uu = vec4 (0, 1.0, 2*x, 3*x*x);
00026     vec4 vv = vec4 (0, 1.0, 2*y, 3*y*y);
00027
00028     vec4 bu = b * u;
00029     vec4 bv = b * v;
00030     vec4 buu = b * uu;
00031     vec4 bvv = b * vv;
00032
00033     mat4 pu[4], pv[4], cu, cv;
00034     for (int i = 0; i < 4; i++) {
00035         for (int j = 0; j < 4; j++) {
00036             pv[i][j] = gl_in[j*4 + i].gl_Position;
00037         }
00038     }
00039     for (int i = 0; i < 4; i++) {
00040         cv[i] = pv[i] * bv;
00041     }
00042
00043     gl_Position = cv * bu;
00044
00045     for (int i = 0; i < 4; i++) {
00046         for (int j = 0; j < 4; j++) {
00047             pu[i][j] = vec4(inData[i*4 + j].normal, 1);
00048             pv[i][j] = vec4(inData[j*4 + i].normal, 1);
00049         }
00050     }
00051     for (int i = 0; i < 4; i++) {
00052         cu[i] = pu[i] * bu;
00053         cv[i] = pv[i] * bv;
00054     }
00055     vec4 du = cv * buu, dv = cu * bvv;
00056     outData.normal = cross(vec3(du), vec3(dv));
00057
00058     for (int i = 0; i < 4; i++) {
00059         for (int j = 0; j < 4; j++) {
00060             pv[i][j] = vec4(inData[j*4 + i].frag_pos, 1);
00061         }
00062     }
00063     for (int i = 0; i < 4; i++) {
00064         cv[i] = pv[i] * bv;
00065     }
00066     outData.frag_pos = vec3(cv * bu);
00067
00068
00069     /*for (int i = 0; i < 4; i++) {
00070         for (int j = 0; j < 4; j++) {
00071             pv[i][j] = vec4(inData[i*4 + i].uv, 0, 1);
00072         }
00073     }
00074     for (int i = 0; i < 4; i++) {
00075         cv[i] = pv[i] * bv;
00076     }
00077     outData.uv = vec2(cv * bu);*/
00078     outData.uv = vec2(x, y);
00079
00080     outData.color = inData[0].color;
00081 }
```

8.82 res/bezier.vert

8.83 bezier.vert

```
00001 #version 420 core
00002 layout (location = 0) in vec3 position;
00003 layout (location = 1) in vec3 normal;
00004 layout (location = 2) in vec4 color;
00005 layout (location = 3) in vec2 uv;
00006
00007 struct Data {
00008     vec4 color;
00009     vec2 uv;
00010     vec3 normal;
00011     vec3 frag_pos;
00012 };
00013
00014 layout(location = 0) out Data data;
00015
00016 uniform mat4 model;
00017 uniform mat4 camera;
00018 uniform mat4 projection;
00019
00020 void main()
00021 {
00022     mat4 trans = projection * camera * model;
00023     vec4 pos = trans * vec4(position, 1.0);
00024     gl_Position = pos;
00025     data.color = color;
00026     data.uv = uv;
00027     data.frag_pos = vec3(model * vec4(position, 1.0));
00028     data.normal = mat3(transpose(inverse(model))) * vec3(normal);
00029 }
```