

# Raydium API Reference

## CQFD Corp.

This document is the most up-to-date version. This is a work in progress: there's again some errors and wrong informations. Try, wait, or contribute ;)

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## 1 Introduction to Raydium:

### 1.1 About:

Well, first of all, let me talk about [Raydium](#) goals: this project aims to be simple, easy to use, portable, and quite fast.

[Raydium](#) is a C written abstract layer, on top of [OpenGL](#), and [GLU](#): this means you can write an entire 3D application without calling any [OpenGL](#) function.

Want to draw an object ? call the suitable [Raydium](#) function, and all textures and vertices will be loaded, and your object drawn.

Want to make an explosion ? Same thing: call the right function.

Note that you can call [OpenGL](#) functions anyway, if necessary.

About portability, I can say a few things: [Raydium](#) was initially planned for Linux only, but with a "clean" (nearly [ANSI](#)) code, and, in facts, we have been able to compile Raydium under Visual Studio (Windows) and mingw with a very few modifications.

So you can expect a correct result on any system providing [OpenGL](#) (at least 1.2), [GLU](#) and a C compiler. Using Raydium as a shared library (.so or DLL), you can also use C++ language for you own applications

As we (Corp?) needed a library for our own games, demos, and... and things like that, and as I was interested by [OpenGL](#), I starts to write [Raydium](#).

Raydium is perfect for outdoors spaces, integrating a landscape engine, with suitable physic, supports dynamic lighting, fog, blending, water and waves, reflections, and more, but also provides everything for indoor, with radiosity lightmaps for example.

Some other advanced features are available : physics, scripting, live video, transparent networking, GUI, shaders, ...

This features list will probably grow up during Raydium developpement, see Raydium website: <http://raydium.org/>

You'll find, in this document, a list of many functions and possibilities of [Raydium](#), but if it's your first view of Raydium, you should start with tutorials ( <http://wiki.raydium.org/wiki/RaydiumTutorials> ) and packaged demo programs.

After this short introduction, let's talk about the [API](#) itself,

starting with the main file (from the programmer's point of vue) of [Raydium](#): common.c

## 1.2 Defines:

As mentioned above, the file common.c is quite interesting, for several reasons: first, as this file includes all others [Raydium](#)'s files, you can have an overview of the whole project, just by looking at this.

It can also be used as a "quick help", since all variables are declared here, and not in the corresponding files. I mean, for example, that "raydium\_light\_intensity..." will be declared in common.c, not in light.c. There's many reasons for using such "style", but you must only retain that it is simpler for you :)

Ok, after this little disclaimer, we can have a look to the first part of our file.

After usual #include (nothing interesting here), we find some #defines.

### generic limits

The first #define block determine limits of your application, and here you are the actual values for basic defines:

```
#define RAYDIUM_MAX_VERTICES 500000
#define RAYDIUM_MAX_TEXTURES 256
#define RAYDIUM_MAX_LIGHTS 8
#define RAYDIUM_MAX_NAME_LEN 255
#define RAYDIUM_MAX_OBJECTS 1024
```

- As you may expect, [MAX\\_VERTICES](#) defines the amount of memory you'll waste with vertex tables. These tables will contain all loaded objects, then remember each time you draw something (object), [Raydium](#) loads it (if not already done). Currently, there is no "delete" mechanism implemented (except by deleting all objects). Let me give you a scale: with an Athlon XP1900+, [GeForce 3](#), actual [Raydium](#) devel. version 0.31, with around 100 000 vertices, lots of options (sky, blending, 2 lights, 15 textures, ...), Raydium renders ~ 45 FPS. Beyond this, a very correct object uses less than 10 000 vertices. So 500 000 vertices, the actual default, is quite large. It's also important to talk about memory: Linux is very efficient on this point, and allocates only "really used" memory. Under Linux, with the above scene, Raydium used about 20 MB (data only), instead of "much more" (~ 5x). I haven't made any test about this under Windows, but we can expect worse results.

- There's nothing really important to say about [MAX\\_TEXTURES](#), since that doesn't influence the amount of memory used. You are not limited to 8 bits values, but 256 seems very comfortable (and you must pay attention to the capacities of your 3D hardware !)

- The next define, [MAX\\_LIGHTS](#) is very important: [OpenGL](#), for now (version 1.3 and lower), impose 8 lights at least, and all current hardware doesn't manage more. If this situation is likely to evolve, we will move this #define to a variable, and will ask hardware for its capacities at initialization, but, for the moment, do not exceed 8.

- Next, `NAME_LEN`, limits the maximum length of strings (textures and objects names) used by Raydium. Default value should be perfect. (avoid higher values, since it could slow down name searches)

- `MAX_OBJECTS` use the same mechanism as `MAX_TEXTURES`, and addition with the fact that hardware is not concerned, it can be ignored.

### Options and parameters

This is the next part of our `#define` section, I will not explain these constants here, but in respective sections, so you'll have just you to remember they're declared here.

### 1.3 Basic vars:

This section aims to describe each variable `Raydium` use, one by one. Some (most ?) of them are used internally only, but you could need to access it. Moreover, you'll better understand how Raydium works by looking at these variables.

### Keyboard input

Following variables can be found:

`raydium_key_last` will always contains the last key (normal or special) pressed down. You'll find a explanation about normal and special keys above.

`raydium_key[]` hosts all special keys state. Currently, you must use `GLUT` define's (Raydium aliases will come soon), limited to following keys:

- `GLUT_KEY_F1` to `GLUT_KEY_F12`
- `GLUT_KEY_LEFT`, `GLUT_KEY_RIGHT`, `GLUT_KEY_UP`, `GLUT_KEY_DOWN`
- `GLUT_KEY_PAGE_UP`, `GLUT_KEY_PAGE_DOWN`
- `GLUT_KEY_HOME`, `GLUT_KEY_END`, `GLUT_KEY_INSERT`

These are "special" keys: they have 2 states. released (0), and pressed (non zero). It means you can do something (move an object, turn on a light) UNTIL user stops to press the key. "Normal" keys have a different behavior: you can do something IF user press a key (exit from application if ESC is pressed, for example). You'll have no information about key's release.

A normal key is sent through `raydium_key_last`, a special one through `raydium_key[]` AND `raydium_key_last`.

You must see `raydium_key_last` as an "event", fired when the user press a key (ANY key: special or not). When a normal key is pressed, you'll get the ASCII value + 1000 assigned to `raydium_key_last`. (1027 for "ESC", for example)

Here is a method to use special keys:

```
if(raydium_key[GLUT_KEY_UP]) move_car();
```

Yes, it's easy. You can also use

```
if(raydium_key_last " "=="GLUT_KEY_UP) explode();
```

for example, if you need to carry out a specific action.

It's ok for you ? use `raydium_key[]` to keep the car moving until user release UP key, or use `raydium_key_last` to explode the car when the user tries to start it :)

## Mouse input

Easy.

You can get actual mouse position on the window (relative to window's position on screen, I mean) with `raydium_mouse_x` and `raydium_mouse_y` (GLuint), starting at (0,0) for upper left (Warning: some [GLUT](#) implementations can give mouse position even when mouse is out of the window ! Check boundaries before using these values).

Raydium use: 1 for left button, 2 for right button, and 3 for middle button (0 for none) with `raydium_mouse_click` for the last click value. (generated one time per click)  
Raydium will now use 4 (up) and 5 (down) for mouse wheel, if any.

You can permanently get a button's state, up (0) or down (non zero), using `raydium_mouse_button[x]`, where x is 0 for left button, 1 for right one, and 2 for middle button.

## Textures

`raydium_texture_index` and `raydium_texture_current_main` (GLuint) are used internally to determine respectively how many textures are loaded, wich is the current one.

The next variable, `raydium_texture_filter`, is very important. You can assign `RAYDIUM_TEXTURE_FILTER_NONE` (default), `RAYDIUM_TEXTURE_FILTER_BILINEAR` or `RAYDIUM_TEXTURE_FILTER_TRILINEAR` (recommended).

Using no texture filter can gives you higher framerate on old 3D hardware, but this is quite ugly.

You can activate bilinear filtering without any framerate impact on most recent video cards, and get a much more attractive rendering.

Trilinear filtering uses Bilinear filtering and [MipMaps](#). A MipMaped? texture is a duplicated texture (3 times, with Raydium), but at different sizes. A 512x512 texture will generate, for example, a (smoothed) 256x256 texture, and a (smoothed) 128x128 one. Your video card will use these textures according to distance from POV (point of vue), reducing flickering effect.

This is the best filtering Raydium can use, for a great rendering quality. Good and recent 3D hardware can do trilinear filtering in a single pass, so it must be the default setting for your application.

About `raydium_texture_filter` itself: changing this variable will not modify the rendering, but the way to load textures. It means you can (for example) use trilinear only for landscape textures, and bilinear for others.

It also means you must reload (erase) a texture to change it's filter.

Note that Raydium will never use trilinear filter with blended (transparent) textures, for good reasons :)

Let's talk quickly about next (internal) texture variables:

`raydium_texture_blended[]` is a flag table, where each element is non zero for a blended (RGBA) texture, and 0 for an RGB one.

For Raydium, when a texture does not contain a "bitmap" (texture file, for example), it contains a plain color, and this color is stored in `raydium_texture_rgb[][4]` (4 is for RGBA, values between 0 and 1). You can load an rgb texture with "rgb" keyword. For example, instead of loading "red.tga", you can load "rgb(0.8,0.1,0.1)".

`raydium_texture_name[]` table simply contains texture filenames.

Last thing, `raydium_texture_to_replace`,

can be used to erase an already loaded texture.

Set the variable to n, and load a new texture: texture number "n" will be replaced in memory.

## Projection

Raydium supports 2 types of projection: `RAYDIUM_PROJECTION_ORTHO` (orthographic) and `RAYDIUM_PROJECTION_PERSPECTIVE`.

First of all, let us point out what "projection" is. Using a "perspective" projection, closest objects will looks larger than the others. It is typically used in video games (since human eye runs like that), by opposition to orthographic projection, wich is mostly used by 3D modeling tools. The principle is simple, discover it by yourself :)

Raydium reads `raydium_projection` to determine wich method to use. Each projection is configured with `raydium_projection_*` variables. Some of these variables are used both by "perspective" and "orthographic" projections.

Here is what common.c says:

```
GLFLOAT RAYDIUM_PROJECTION_FOV; // PERSPECTIVE ONLY
GLFLOAT RAYDIUM_PROJECTION_NEAR; // PERSPECTIVE & ORTHO
GLFLOAT RAYDIUM_PROJECTION_FAR; // PERSPECTIVE & ORTHO
GLFLOAT RAYDIUM_PROJECTION_LEFT; // ORTHO ONLY
GLFLOAT RAYDIUM_PROJECTION_RIGHT; // ORTHO ONLY
GLFLOAT RAYDIUM_PROJECTION_BOTTOM; // ORTHO ONLY
GLFLOAT RAYDIUM_PROJECTION_TOP; // ORTHO ONLY
```

You've probably noticed that orthographic projection defines a "box" with your screen: near, far, left, right, bottom. Everything out ouf this box will never be displayed.

Perspective projection is based on FOV: Field Of Vision, given in degrees. A common "human" fov is 60°, up to 90° without any noticeable deformat ion. "near" and "far" are used for many things: Z-Buffer precision is affected,

and clipping too: as with "orthographic", nothing will be displayed beyond "far", and fog, if enabled, will hide this "limit". This is right for "near", too, but without fog, obviously :)

Also remember that decreasing FOV will zoom in.

You must call `raydium_window_view_update()` after any modification on one (or more) of these variables (see "Window Management" section for more information)

### Frame size and color

`raydium_window_tx` and `raydium_window_ty` are read-only variables, providing you actual frame size.

`raydium_background_color[4]` is a RGBA table, and will be used for frame clearing, and fog color. You can change this variable, and call respective update functions (frame and fog), or simply use `raydium_background_color_change(GLfloat r, GLfloat g, GLfloat b, GLfloat a)`.

More informations in corresponding sections.

### Vertices

Vertices data structure is distributed in 4 parts:

- `raydium_vertex_*` : these tables will simply contains vertices coordinates
- `raydium_vertex_normal_*` : vertices normals. Raydium will maintain two distinct normal tables, and this one will be used for calculations.
- `raydium_vertex_normal_visu_*` : the other normal table, used for lighting. Smoothing "visu" normals will provides a better rendering, and Raydium includes all necessary functions to automate this task.
- `raydium_vertex_texture_u`, `*raydium_vertex_texture_v`, `*raydium_vertex_texture` contains, for each vertex stored in the vertices data structure, u and v mapping information, and associated texture number. U and V are texture mapping coordinates.

Raydium can automatically generates some of these data (normals and uv coords, that is), Read "Vertices" section above for more information.

PLEASE, do not write directly in these tables, use dedicated functions.

### Objects

Objects are loaded in Vertices stream, identified by a "start" and an "end" (`raydium_object_start[]` and `raydium_object_end[]`) in this stream. An index is incremented each time you load an object (`GLuint raydium_object_index`). Filename is also stored in `raydium_object_name[][]`. Go to "Objects" section to know more.

### Lights

First of all, `raydium_light_enabled_tag` contains 0 when light is disabled, non-zero otherwise. This is a read-only variable, so use suitable functions.

Currently, for Raydium, a light can have 3 states: on, off, or blinking. `raydium_light_internal_state[]` stores this.

Next comes all light's features: position, color, intensity. You can modify directly these variables, and call update fonctions, if needed (not recommended).

Next, `raydium_light_blink_*` are used internaly for blinking lights, setting lowest, higher light intensity, and blinking speed. Do noy modify these variables, use suitable functions.

You should read the chapter dedicated to lights for more information.

## Fog

Only one variable, here: `raydium_fog_enabled_tag`, switching from zero to non zero if fog is enabled. Do NOT use this variable to enable or disable fog, but suitable functions, this variable is just a tag.

## Camera

Since many calls to camera functions are done during one frame, Raydium must track if any call to these functions was already done, using `raydium_frame_first_camera_pass` boolean.

`raydium_camera_pushed`, also used as a boolean, stores stack state. When you place your camera in the scene with Raydium, it pushes matrix on top of the stack, so you can modify it (the matrix), placing an object for example, an restore it quickly after, by popping matrix off.

## 2 Maths:

### 2.1 Little introduction to trigo.c:

This section is mostly designed for internal uses, but provides some usefull maths functions, mostly for trigonometrical uses.

### 2.2 GLfloat raydium\_trigo\_cos (GLfloat i):

Obvious (degrees)

### 2.3 GLfloat raydium\_trigo\_sin (GLfloat i):

Obvious (degrees)

### 2.4 GLfloat raydium\_trigo\_cos\_inv (GLfloat i):

Obvious (degrees)

### 2.5 GLfloat raydium\_trigo\_sin\_inv (GLfloat i):

Obvious (degrees)

### 2.6 raydium\_trigo\_abs(a) (macro):

Obvious

### 2.7 raydium\_trigo\_min(a,b) (macro):

Obvious

### 2.8 raydium\_trigo\_max(a,b) (macro):

Obvious

### 2.9 raydium\_trigo\_isfloat(a) (macro):

Test two cases : "Not a Number" and "Infinite"

### 2.10 raydium\_trigo\_round(a) (macro):

Will obviously "round" `a` instead of the default C floor behaviour

### 2.11 void raydium\_trigo\_rotate (GLfloat \* p, GLfloat rx, GLfloat ry, GLfloat rz, GLfloat \* res):

Rotate `p` (GLfloat \* 3) by (rx,ry,rz) angles (degrees).

Result is stored in `res` (GLfloat \* 3)

### 2.12 void raydium\_trigo\_pos\_to\_matrix (GLfloat \* pos, GLfloat \* m):

Generates a ODE style matrix (16 GLfloat) from `pos` (GLfloat \* 3)

### 2.13 void raydium\_trigo\_pos\_get\_modelview (GLfloat \* res):

Stores the current [OpenGL](#) MODELVIEW matrix in `res` (16 GLfloat)

### 2.14 int raydium\_trigo\_pow2\_next(int value):

Returns next power of two of `value`. Ugly.

### 2.15 Matrix functions:

Here there are a few functions also designed for internal uses that aims only at matrices. Really the main objective of these functions is give support for the inverse function.

The data type `matrix4x4` is really an 16 double array.

### 2.16 double raydium\_matrix\_determinant(matrix4x4 matrix):

Returns the `determinant` of the given matrix.

### 2.17 matrix4x4 raydium\_matrix\_adjoint(matrix4x4 matrix):

Returns the `adjoint matrix` of the given matrix.

### 2.18 matrix4x4 raydium\_matrix\_multiply(matrix4x4 matrix1, matrix4x4 matrix2):

Returns the resulting matrix of the multiplication of 2 matrices.

Remember that the multiplication of matrices doesn't have the commutative property, so is not equal `matrix1 X matrix2` than `matrix2 x matrix1`.

### 2.19 matrix4x4 raydium\_matrix\_inverse(matrix4x4 matrix):

Returns the inverse matrix of a given matrix.

### 2.20 double raydium\_matrix\_internal\_determinant(matrix4x4 matrix, int dimension):

internal, don't use.

### 2.21 matrix4x4 raydium\_matrix\_internal\_adjoint(matrix4x4 matrix, int dimension):

internal, don't use.

### 2.22 matrix4x4 raydium\_matrix\_internal\_multiply(matrix4x4 matrix\_one, matrix4x4 matrix\_two, int dimension):

internal, don't use.

### 2.23 matrix4x4 raydium\_matrix\_internal\_inverse(matrix4x4 adjoint\_matrix,double det,int dimension):

internal, don't use.

## 3 Logging:

### 3.1 Introduction to log.c:

Raydium uses and provides his own logging system, hidden behind a single function, as shown below.

### 3.2 void raydium\_log (char \*format, ...):

This function must be used like "printf", using a format ("%s, %i, %x, ...") and then, suitable variables, but without the end-line char ("\n")

```
raydium_log("You are player %i, %s", player_number, player_name);
```

For now, this function writes to the parent terminal and the in-game console, with "Raydium: " string prefix. The user can force logging to a file, using `--logfile` command line switch.

## 4 Random:

### 4.1 Introduction:

These functions deals with random numbers generation.

### 4.2 void raydium\_random\_randomize (void):

This function initialize the random number generator with current time for seed.

Note: You are not supposed to use this function.

### 4.3 GLfloat raydium\_random\_pos\_1 (void):

"positive, to one":  $0 \leq \text{res} \leq 1$

### 4.4 GLfloat raydium\_random\_neg\_pos\_1 (void):

"negative and positive, one as absolute limit":  $-1 \leq \text{res} \leq 1$

### 4.5 GLfloat raydium\_random\_0\_x (GLfloat i):

"zero to x":  $0 \leq \text{res} \leq x$

### 4.6 GLfloat raydium\_random\_f (GLfloat min, GLfloat max):

$\text{min} \leq \text{res} \leq \text{max}$  (float)

### 4.7 int raydium\_random\_i (int min, int max):

$\text{min} \leq \text{res} \leq \text{max}$  (integer)

### 4.8 signed char raydium\_random\_proba (GLfloat proba):

Returns true or false (0 or 1) depending of "proba" factor.

`proba` must be:  $0 \leq \text{proba} \leq 1$

ex: 50% = 0.5

## 5 Fog:

### 5.1 Introduction:

Fog is usefull for two major reasons:

1. Realism: Just try, and you'll understand:  
amazing depth impression, no ?
2. Speed: For a correct fog effect (i'm talking about estetic aspect), you must bring near\_clipping to a closer value,

reducing the overall number of triangles displayed at the same time.

There are 3 types of fog. They are:

\* Linear:

Far-z

fog=

Far-Near

\* Exp:

(-density\*z)

fog= e^

\* Exp2?:

(-density\*z)^2

fog= e^

Above *z* is the distance to the calculated point from the camera.

As you can see, linear mode doesn't use *Density*; and Exp & Exp2? modes don't use near and far values. Remember that.

## 5.2 void raydium\_fog\_enable (void):

Obvious

## 5.3 void raydium\_fog\_disable (void):

Obvious

## 5.4 void raydium\_fog\_color\_update (void):

If you have modified [raydium\\_background\\_color](#) array, you must call this function, applying the specified color to hardware.

See also: [raydium\\_background\\_color\\_change](#)

## 5.5 void raydium\_fog\_mode(GLuint mode):

The fog mode can be change with this function. There are 3 different ways to apply the fog:

1. [RAYDIUM\\_FOG\\_MODE\\_LINEAR](#) - Used by default, the fog is directly applied according the distance. Not real world fog, but used to avoid drawing too distant objects.

**IMPORTANT:** EXP mode ignores the *density* value, only uses *near* and *far*.

2. [RAYDIUM\\_FOG\\_MODE\\_EXP](#) - The fog grows exponentially with the distance. Usual mist in the real world.

**IMPORTANT:** EXP mode ignores the *near* and *far* values, only uses the *density*.

3. [RAYDIUM\\_FOG\\_MODE\\_EXP2](#) - The fog grows twice exponentially with the distance. Used when the observer is inside a cloud/mist.

**IMPORTANT:** EXP2 mode ignores the *near* and *far* values, only uses the *density*.

## 5.6 void raydium\_fog\_density(GLfloat density):

Sets the density of the fog.

Useless if you are using LINEAR mode.

### 5.7 void raydium\_fog\_near(GLfloat near):

Sets the near point to apply the fog.  
Useless if you are using EXP or EXP2 modes.

### 5.8 void raydium\_fog\_far(GLfloat far):

Sets the far point of the fog.  
Useless if you are using EXP or EXP2 modes.

### 5.9 void raydium\_fog\_apply(void):

Used to apply changes in your setup of fog.  
Also is used to continue a previously stopped fog.  
See: [raydium\\_fog\\_wait\(\)](#) below.

### 5.10 void raydium\_fog\_wait(void):

With this function you can deactivate TEMPORALY the fog, but the internal state of the fog in Raydium won't change, so when you use [raydium\\_fog\\_apply](#), the fog will continue like it was before being stoped.  
It's very usefull for certain rendering effects that need to stop the fog temporaly.

### 5.11 void raydium\_fog\_volumetric\_support(void):

With this function, you're saying to Raydium that you want a support for volumetric fog in you application. Call this function as soon as possible after engine init, since it will change the way Raydium renders objects (think about display lists).

### 5.12 void raydium\_fog\_volumetric\_enable(void):

When you call this function, fog is no more applied using fragment depth, but using [RENDER\\_VOLUMETRIC\\_FOG\\_AXIS](#) (see [config.h](#)).  
You must have called [raydium\\_fog\\_volumetric\\_support\(\)](#) before enabling volumetric fog.

### 5.13 void raydium\_fog\_volumetric\_disable(void):

Reset fog sytem to default behavior (fragment depth).

## 6 Window management:

### 6.1 Introduction:

Some important functions, used for window creation and managment.

### 6.2 void raydium\_window\_close (void):

This function is called by Raydium, do not use.

### 6.3 void raydium\_window\_create (GLuint tx, GLuint ty, signed char rendering, char \*name):

You must call this function once in your program, with following arguments:

1. `tx, ty`: window size, in pixel
2. `rendering`: window mode: [RAYDIUM\\_RENDERING\\_\\*](#) (NONE, WINDOW, FULLSCREEN)
3. `name`: window's name

Raydium is using GLUT for window management, and GLUT fullscreen is not the same between various implementations, and can fail, so use a standard window size (640x480, 800x600, ...) for fullscreen mode.

Note that user can force fullscreen using `--fullscreen` on the command line.

## 6.4 void raydium\_window\_resize\_callback (GLsizei Width, GLsizei Height):

This function is automatically called during a window resize, and resize [OpenGL](#) rendering space.

There is almost no reason to call this function by yourself.

## 6.5 void raydium\_window\_view\_update (void):

If you've changed 3D window size (clipping: `raydium_projection_*`), apply to hardware with this function.

## 6.6 void raydium\_window\_view\_perspective(GLfloat fov, GLfloat fnear, GLfloat ffar):

All-in-one function: sets all "perspective" variables, and updates.

# 7 Capture (2D):

## 7.1 Quickview:

Captures are made in TGA (without RLE compression) or JPEG formats and saved into the current directory.

These functions may fail (garbage in resulting capture) if frame size if not "standard", mostly after a window resize.

Also there are "auto" functions that provide a simplest method to make an screen capture. [So, the](#) following example (put into the `display()` function), allows jpeg screenshots just pressing F9 key:

```
if(raydium_key_last
9) raydium_capture_frame_jpeg_auto();
```

Raydium also allow you to capture movies: activate `DEBUG_MOVIE` option in `raydium/config.h` with the needed framerate, and press F11. Raydium will use a dedicated time line, allowing smooth capture. This system may cause strange behaviours with movies providing network action.

The movie is stored in multiples files in `movie` directory, and you can use mencoder like this:

```
mencoder -ovc lavc -lavcopts vcodec=mpeg4:vhq:vbitrate=780
mf://\*.tga -vf scale=320:240 -mf fps=25 -o ~/ray.avi
```

You can also use audio file adding this:

```
-audiofile audio.mp3 -oac copy for example.
```

## 7.2 void raydium\_capture\_frame(char \*filename):

Capture current frame to `filename`.

## 7.3 void raydium\_capture\_frame\_auto(void):

Same as above, but to an auto-generated filename (`raycap*`).

## 7.4 void raydium\_capture\_frame\_jpeg(char \*filename):

Same as `raydium_capture_frame()` but using JPEG image format.

See `raydium/config.h` for quality setting.

## 7.5 void raydium\_capture\_frame\_now(char \*filename):

Same as `raydium_capture_frame()`, but without waiting the end of the frame, saving the hardware color buffer, whatever it contains. Use with caution.

## 7.6 void raydium\_capture\_frame\_jpeg\_now(char \*filename):

Same as above, but using JPEG image format.

## 7.7 void raydium\_capture\_filename\_auto(char \*dest,char \*format):

Internal Use. Generates filenames for new screenshots.

### 7.8 void raydium\_capture\_frame\_auto(void):

Capture the current frame giving the resulting file and automatic name.

### 7.9 void raydium\_capture\_frame\_jpeg\_auto(void):

Same as above, but using JPEG image format.

## 8 Background:

### 8.1 void raydium\_background\_color\_change (GLfloat r, GLfloat g, GLfloat b, GLfloat a):

Will change `raydium_background_color` array and apply this modification.

(will update fog color, obviously).

## 9 Frame clearing:

### 9.1 void raydium\_clear\_frame (void):

You need to call this function every frame to clear all hardware buffers.

### 9.2 void raydium\_clear\_color\_update (void):

Will apply background color modification. Probably useless for you.

## 10 Lights:

### 10.1 Introduction to Raydium light system:

When we starts Raydium development, the main idea was to use native [OpenGL](#) lights, and not lightmaps or another method.

This method (native lights) provides 8 simultaneous movable lights, and is quite effective with recent [OpenGL](#) hardware.

You can modify intensity, position, color, you can turn on any light at any time, make them blinking... Mixing all theses features can result many effects, as realtime sunset, flashing lights for cars, explosions, ...

Usage is very easy: no need to create lights, just turn them on.

See also: [LightMaps](#)

### 10.2 void raydium\_light\_enable (void):

Obvious.

### 10.3 void raydium\_light\_disable (void):

Obvious.

### 10.4 signed char raydium\_light\_texture(int texture, signed char enable):

Texture 1 will not use lighting if `enable` is set to 0. Call this function before loading any object using this texture, because of display lists. Same way, it's not possible to change back this value after the first object drawing without disabling display lists.

### 10.5 signed char raydium\_light\_texture\_name(char \*name, signed char enable):

Same as above, but using texture `name`.

### 10.6 GLuint raydium\_light\_to\_GL\_light (GLuint l):

Probably useless for end user. (internal uses)

### 10.7 void raydium\_light\_on (GLuint l):

Turns `l` light on ( `0 <= l <= RAYDIUM_MAX_LIGHTS` )

### 10.8 void raydium\_light\_off (GLuint l):

Turns `l` light off

### 10.9 void raydium\_light\_switch (GLuint l):

Will switch `l` light state (from "on" to "off", for example).

### 10.10 void raydium\_light\_update\_position (GLuint l):

Updates `raydium_light_position[l]` array changes to hardware.

This function is now used internally by Raydium, so you have no reasons to call it by yourself.

### 10.11 void raydium\_light\_update\_position\_all (void):

See above.

### 10.12 void raydium\_light\_update\_intensity (GLuint l):

See above.

### 10.13 void raydium\_light\_update\_all (GLuint l):

See above.

### 10.14 void raydium\_light\_move (GLuint l, GLfloat \* vect):

Moves light to position `vect` for light `l` (`vect` is `GLfloat[4]`: x,y,z,dummy).

Just move your lights before camera placement, or your changes will be applied to the next frame only.

### 10.15 void raydium\_light\_reset (GLuint l):

This function will restore all defaults for `l` light.

### 10.16 void raydium\_light\_blink\_internal\_update (GLuint l):

Useless for end-user.

### 10.17 void raydium\_light\_blink\_start (GLuint l, int fpc):

Makes `l` light blinking at `fpc` (frames per cycle) rate.

This function will use timecalls soon ("fpc" -> "hertz")

### 10.18 void raydium\_light\_callback (void):

Useless for end-user.

## 11 Keyboard & keys:

### 11.1 void raydium\_key\_normal\_callback (GLuint key, int x, int y):

Internal callback.

### 11.2 void raydium\_key\_special\_callback (GLuint key, int x, int y):

Internal callback.

### 11.3 void raydium\_key\_special\_up\_callback (GLuint key, int x, int y):

Internal callback.

### 11.4 int raydium\_key\_pressed (GLuint key):

Will return state of `key` in the `raydium_keys[]` array.

This function is useful to test keyboard from PHP, since [RayPHP](#) does not support array for now.

## 12 Mouse:

### 12.1 Introduction:

Mouse API is almost explained at the top of this guide, but here it is some other usefull functions (macros, in facts)

### 12.2 `raydium_mouse_hide()` (macro):

Hides mouse cursor.

### 12.3 `raydium_mouse_show()` (macro):

Shows mouse cursor.

### 12.4 `raydium_mouse_move(x,y)` (macro):

Moves cursor to `(x,y)` position (in pixel).

Example if you want to move cursor at window's center:

```
raydium_mouse_move(raydium_window_tx/2, raydium_window_ty/2);
```

### 12.5 `signed char raydium_mouse_isvisible(void)`:

Returns true or false (0 or 1), if the mouse is visible or not.

See `raydium_mouse_show()` and `raydium_mouse_hide()` above.

### 12.6 `void raydium_mouse_init (void)`:

Internal use.

### 12.7 `void raydium_mouse_click_callback (int but, int state, int x, int y)`:

Internal callback.

### 12.8 `void raydium_mouse_move_callback (int x, int y)`:

Internal callback.

### 12.9 `int raydium_mouse_button_pressed (int button)`:

returns `button` state. (See first part of this document)

## 13 Textures:

### 13.1 Introduction:

For now, Raydium only handles TGA uncompressed texture.

As explained in the first part of this guide, Raydium provides three texture filters (none, bilinear, trilinear using [MipMaps](#) ).

Texture sizes must be a power of two, 8 (alpha mask), 24 (RGB) or 32 (RGBA) bits.

Raydium supports simple color materials, using a `"rgb(r,g,b)"` string as texture name, where r, g and b are  $0 \leq x \leq 1$  (floats).

With 3 negative values, you will generate a "phantom texture". Phantom textures are only drawn into the z-buffer (and not color buffer).

Texture clamping and advanced multitexturing effects are supported by Raydium, but not documented here for now. If you're interested, have a look at source code, or take a look at the Wiki. Tips: "BOX", "ENV", "HDR", ";", "|".

Effective environment mapping (one pass, two texture units) is available using a special filename separator for texture field in TRI files : #

See this example:

```
0.232258 0.225387 -0.149804 0.012198 -0.274925 0.961388 0.731411 0.980236
```

`fiesta_diffuse.tga#ENV_map.tga`

Environment texture name must start with "ENV" to allow spherical mapping, which is needed for such effect. See also `RAYDIUM_RENDER_REFLECTION_FACT` in file `common.h` if you want reflection to be more or less visible.

### 13.2 signed char raydium\_texture\_size\_is\_correct (GLuint size):

Returns true if `size` is a correct texture size, depending of hardware capacities and "power of 2" constraint.

### 13.3 GLuint raydium\_texture\_load\_internal(char \*filename, char \*as, signed char faked, int faked\_tx, int faked\_ty, int faked\_bpp, int or\_live\_id\_fake):

Internal use.

### 13.4 GLuint raydium\_texture\_load (char \*filename):

Loads "filename" texture into hardware memory. Function results texture index, but in most cases, you can identify later a texture by his name, without providing his index, so you can probably ignore this value.

0 is returned if texture loading have failed.

### 13.5 GLuint raydium\_texture\_load\_erase (char \*filename, GLuint to\_replace):

Same as above, but `to_replace` texture (index) is erased with `filename`.

### 13.6 signed char raydium\_texture\_current\_set (GLuint current):

Switch active texture to "current" index. Mostly used for runtime object creation:

"set current texture, add vertices, set another texture, add vertices, ... and save all to an objet"  
(see below for vertices management).

### 13.7 signed char raydium\_texture\_current\_set\_name (char \*name):

Same as above, but using texture name. This function will load `name` if not already done.

### 13.8 GLuint raydium\_texture\_find\_by\_name (char \*name):

Returns index for texture "name", and load it if not already done.

### 13.9 GLuint raydium\_texture\_exists(char \*name):

Same as above, but don't load texture if `name` isn't already loaded and then returns -1. Returns texture id otherwise.

### 13.10 void raydium\_texture\_filter\_change (GLuint filter):

Change texture filter. The new filter will apply on all "next" textures, but will not change already loaded ones (this was the case in old Raydium releases), since it may generate strange bugs with dynamic (aka "faked") textures, and it was very slow.

```
// will switch to bilinear filter for next textures
raydium_texture_filter_change(RAYDIUM_TEXTURE_FILTER_BILINEAR)
```

## 14 Rendering:

**14.1 void raydium\_render\_lightmap\_color(GLfloat \*color):**

You may force a new lightmap rendering color "filter" anytime with this function, allowing advanced lighting effects.

HUGE WARNING: You must turn off display lists if you change this value after first object's render.

See [raydium\\_rendering\\_displaylists\\_disable\(\)](#) if needed.

**14.2 void raydium\_render\_lightmap\_color\_4f(GLfloat r, GLfloat g, GLfloat b, GLfloat a):**

Same as above, using 4 values.

**14.3 int raydium\_rendering\_prepare\_texture\_unit (GLenum tu, GLuint tex):**

This function will "prepare" hardware texture unit `tu` to render `tex` texture.

There almost no reason to call this function by yourself.

**14.4 void raydium\_rendering\_internal\_prepare\_texture\_render (GLuint tex):**

Same as above, but for texture unit #0 only.

**14.5 void raydium\_rendering\_internal\_restore\_render\_state (void):**

Internal. Deprecated.

**14.6 void raydium\_rendering\_from\_to\_simple(GLuint from, GLuint to):**

Same as [raydium\\_rendering\\_from\\_to\(\)](#), but only with vertices (no

UV, no normals, no textures, no colors, ...).

Mostly used for internal shadow maps creation.

**14.7 void raydium\_rendering\_from\_to (GLuint from, GLuint to):**

Renders vertices from `from` to `to`.

Using object management functions is a better idea.

**14.8 void raydium\_rendering (void):**

Renders all vertices (probably useless, now).

**14.9 void raydium\_rendering\_finish (void):**

You must call this function at the end of each frame. This will flush all commands to hardware, fire a lot off callbacks, and prepare next frame.

**14.10 void raydium\_rendering\_wireframe (void):**

Switch to wireframe rendering.

**14.11 void raydium\_rendering\_normal (void):**

Switch back to standard rendering.

**14.12 void raydium\_rendering\_rgb\_force (GLfloat r, GLfloat g, GLfloat b):**

Force all RGB colored vertices to take `(r,g,b)` color. One example of this use is for making "team colored" cars : Do not apply textures to some faces while modelling, and force to team color each time you render a car.

**14.13 void raydium\_rendering\_rgb\_normal (void):**

Disable "rgb force" state. See above.

**14.14 void raydium\_rendering\_displaylists\_disable(void):**

Disable display lists usage.

Some old video cards and broken drivers may get better performances WITHOUT display lists (on large objects, mainly).

**14.15 void raydium\_rendering\_displaylists\_enable(void):**

Enable display lists usage. default state.

## 15 Particle engine:

### 15.1 Introduction:

This is the second version of Raydium's particle engine. This engine is build on top of a dedicated file format (.prt and .sprt files), describing most (up to all, in facts) properties of generators.

It probably better to start by an example (fountain.prt) :

```
// Simple blue fountain (change 'vector' if needed)
ttl_generator=5;
ttl_particles=1.5;
ttl_particles_random=0;

particles_per_second=200;

texture="flare_nb.tga";

size=0.1;
size_inc_per_sec=0.1;

gravity={0,0,-5};
vector={0,0,4};
vector_random={0.2,0.2,0.2};

// RGBA
color_start={0.6,0.6,1,0.5};
color_start_random={0,0,0.2,0};
color_end={1,1,1,0.1};

// end of file.
```

.prt files are readed using parsing functions (see appropriate chapter, if needed), and the list of all available properties can be found in particle2.c source file. A full totutorial is also available on Raydium's Wiki.

Once the particle file is written, you only need to load the file using the suitable function (see below). Some anchor are available to link generators to physic entities, if needed, as callbacks for a few events (one, for now).

.sprt files are used to create a "snapshot" of particles, used for example by 3D captures, and are not meant to be edited by hand.

### 15.2 void raydium\_particle\_name\_auto (char \*prefix, char \*dest):

Will generate a unique string using `prefix`. The string is created using space provided by `dest`.

You can use this function when building a new generator.

### 15.3 void raydium\_particle\_init (void):

Internal use.

### 15.4 signed char raydium\_particle\_generator\_isvalid (int g):

Internal use, but you can call this function if you want to verify if a generator's id is valid (in bounds, and loaded).

**15.5 int raydium\_particle\_generator\_find (char \*name):**

Lookups a generator using its name. Returns -1 if [name](#) is not found.

**15.6 int raydium\_particle\_find\_free (void):**

Finds a free particle slot.

**15.7 void raydium\_particle\_generator\_delete (int gen):**

Deletes a generator.

**15.8 void raydium\_particle\_generator\_delete\_name (char \*gen):**

Same as above, but using generator's name.

**15.9 void raydium\_particle\_generator\_enable (int gen, signed char enabled):**

Activate a disabled generator (see below).

**15.10 void raydium\_particle\_generator\_enable\_name (char \*gen, signed char enable):**

Disable a generator (TTL is still decremented).

**15.11 void raydium\_particle\_preload (char \*filename):**

Loads .prt file and associated textures into suitable caches.

Call this function if you want to avoid (small) jerks caused by "live" loading a generator.

**15.12 void raydium\_particle\_generator\_load\_internal (int generator, FILE \* fp, char \*filename):**

Internal use.

**15.13 int raydium\_particle\_generator\_load (char \*filename, char \*name):**

Loads generator from [filename](#) as [name](#). This [name](#) will be used for future references to this generator, as the returned integer id.

**15.14 void raydium\_particle\_generator\_update (int g, GLfloat step):**

Internal use.

**15.15 void raydium\_particle\_update (int part, GLfloat step):**

Internal use.

**15.16 void raydium\_particle\_callback (void):**

Internal use.

**15.17 int raydium\_particle\_state\_dump(char \*filename):**

Dumped current particles to [filename](#) (.sprt [static particles]).

**15.18 int raydium\_particle\_state\_restore(char \*filename):**

Append .sprt [filename](#) to current scene.

**15.19 void raydium\_particle\_draw (raydium\_particle\_Particle \* p, GLfloat ux, GLfloat uy, GLfloat uz, GLfloat rx, GLfloat ry, GLfloat rz):**

Internal use.

**15.20 void raydium\_particle\_draw\_all (void):**

Internal use.

**15.21 void raydium\_particle\_generator\_move (int gen, GLfloat \* pos):**

Moves [gen](#) generator to [pos](#) position (3 \* GLfloat array).

**15.22 void raydium\_particle\_generator\_move\_name (char \*gen, GLfloat \* pos):**

Same as above, but using generator's name.

**15.23 void raydium\_particle\_generator\_move\_name\_3f (char \*gen, GLfloat x, GLfloat y, GLfloat z):**

Same as above, using 3 different GLfloat values.

**15.24 void raydium\_particle\_generator\_particles\_OnDelete (int gen, void \*OnDelete?):**

Sets a callback for `gen`, fired when any particle of this generator is deleted, providing a easy way to create "cascading" generators.

The callback must respect the following prototype:

```
void cb(raydium_particle_Particle *)
```

Do not free the provided particle.

**15.25 void raydium\_particle\_generator\_particles\_OnDelete\_name (char \*gen, void \*OnDelete?):**

Same as above, but using generator's name.

**15.26 void raydium\_particle\_scale\_all(GLfloat scale):**

Will scale all particles with `scale` factor. Use with caution.

Default is obviously 1.

**16 Callbacks:****16.1 Introduction:**

This file contains many initializations, a few internal callbacks, but will provides a very important function for end-user, wich will gives user display function to Raydium: see below

**16.2 void raydium\_callback\_image (void):**

Internal use.

**16.3 void raydium\_callback\_set (void):**

Internal use.

**16.4 void raydium\_callback (void (\*loop)):**

This function will loop over the provided display function, indefinitely.

"loop" must be:

```
void loop(void)
```

**17 Normals:****17.1 Introduction:**

This file provides some usefull functions for normal generation and smoothing.

You can find some more informations about normals at the top of this guide.

**17.2 void raydium\_normal\_generate\_lastest\_triangle (int default\_visu):**

Generate normal for the last created triangle (see `raydium_vertex_index`)

if `default_visu` is true ( `!= 0` ), this function will restore "visu"

normals too.

### 17.3 void raydium\_normal\_restore\_all (void):

This function restore visu normals with standard ones (`raydium_vertex_normal_*`)

### 17.4 void raydium\_normal\_regenerate\_all (void):

This function will regenerate standard and visu normals for the whole scene (ground, objects, ...).

### 17.5 void raydium\_normal\_smooth\_all (void):

This function will smooth the whole scene, using adjacent vertices.

Note this function can take a lot of time.

### 17.6 void raydium\_normal\_smooth\_from\_to(GLuint from, GLuint to):

Same as above, but only from `from` vertex to `to` vertex (excluded).

In other words: will smooth [from;to[

## 18 vertices:

### 18.1 Introduction:

You can create objets at runtime, if needed, using the following functions.

Each of theses functions adds only one vertex so, obviously, you need to call three time the same function to add one triangle.

### 18.2 void raydium\_vertex\_add (GLfloat x, GLfloat y, GLfloat z):

Adds a vertex at (`x`, `y`, `z`).

### 18.3 void raydium\_vertex\_uv\_add (GLfloat x, GLfloat y, GLfloat z, GLfloat u, GLfloat v):

Same as above, but providing texture mapping informations with `u` and `v`.

### 18.4 void raydium\_vertex\_uv\_normals\_add (GLfloat x, GLfloat y, GLfloat z, GLfloat nx, GLfloat ny, GLfloat nz, GLfloat u, GLfloat v):

Same as above, giving vertex's normal with (`nx`, `ny`, `nz`).

## 19 Land:

### 19.1 Introduction:

Historically, this file was quite complex, since Raydium was using his own physic. Now, this file is almost empty, since ODE integration now provides new landscape functions.

## 20 Sky and environnement boxes:

### 20.1 Introduction:

Skyboxes are mostly automated.

For now, Raydium will use `BOXfront.tga`, `BOXback.tga`, `BOXleft.tga`, `BOXright.tga`, `BOXbottom.tga` and `BOXtop.tga` and will draw a skybox only if fog is disabled (this is not for technical reasons, but only for realism, just think about it ;)... but you can force skybox with fog using `raydium_sky_force` if you really want).

### 20.2 void raydium\_sky\_box\_cache (void):

As skybox texture are sometimes large files, you can pre-load skybox with this function. If you don't do it, Raydium will load textures during the first frame of your application.

Calling this function will automatically define sky as a HDR emitter.

See HDR chapter for more information.

### 20.3 void raydium\_sky\_box\_render (GLfloat x, GLfloat y, GLfloat z):

Internal use.

### 20.4 void raydium\_sky\_sphere\_render(GLfloat x, GLfloat y, GLfloat z, int detail):

Internal use.

Calculates and draw the sphere. Also rotate it according the angles or orbit.

### 20.5 Atmosphere:

Atmosphere are series of effects that intend to make the sky and the atmosphere of the game more realistic. As this is quite-beta state, only a orbital sky effect is available right now.

To activate/deactivate this series of effects, you should use:

[raydium\\_sky\\_atmosphere\\_enable](#) and [raydium\\_sky\\_atmosphere\\_disable](#) respectively.

If you need to check if the atmosphere is activated or not, use [raydium\\_sky\\_atmosphere\\_check](#). The rest of the functions are internal and should not used by normal programs.

### 20.6 void raydium\_sky\_atmosphere\_enable(void):

turn on the use of atmosphere effects.

This one and `_disable` function a program should use, the other [raydium\\_sky\\_atmosphere\\_](#) are internal ones.

### 20.7 void raydium\_sky\_atmosphere\_disable(void):

turn off the use of atmosphere effects.

### 20.8 void raydium\_sky\_atmosphere\_render(GLfloat x, GLfloat y, GLfloat z,int detail):

Internal use. This internal function draws the atmosphere effects. Right now only draws a rotating sphere with a gradient of color (from black to white). In a future, it will draw multiples layers of sky (with and without textures), stars, satellites... Maybe rain and snow could be included here also.

### 20.9 signed char raydium\_sky\_atmosphere\_check(void):

This functions only check if the atmosphere features are been used. Returns 1 if they are used, else 0.

## 21 "Internal" informations access:

### 21.1 void raydium\_internal\_dump (void):

This function is now systematically called by Raydium at application's exit, displaying some informations about loaded textures, objects, registered data, network statistics.

### 21.2 void raydium\_internal\_dump\_matrix (int n):

Dumps matrix to console.

`n` values are:

```
0 for GL_PROJECTION_MATRIX
1 for GL_MODELVIEW_MATRIX
```

## 22 Files (generic):

### 22.1 Introduction:

File support is now splitted in two parts: generic functions and TRI format specific functions. This chapter talks about generic part, where you'll find some libc replacements and wrappers, and functions dealing with "private directory" of the current user.

### 22.2 void raydium\_file\_dirname(char \*dest,char \*from):

Reliable and portable version of libc's `dirname` function.

This function extracts directory from `from` filename, and writes it to `dest`.

No memory allocation will be done by the function.

### 22.3 void raydium\_file\_basename(char \*dest,char \*from):

Another libc clone, for `basename` function. Extracts file name from a path into `dest` string.

### 22.4 void raydium\_file\_ext(char \*dest, char \*from):

Return the extension of `from` filename (can be a complete path), without the `.` (dot), or an empty string if extension is not found.

### 22.5 signed char raydium\_file\_directory\_writable(char \*path):

Return 1 if `path` directory is writable, 0 otherwise.

### 22.6 signed char raydium\_file\_readable(char \*filename):

Return 1 if `filename` exists and is readable, 0 otherwise.

### 22.7 void raydium\_file\_log\_fopen\_display(void):

Display (console) all filenames that were opened before the call.

`--files` command line option will call this function at the application's exit, closed or not.

### 22.8 FILE \*raydium\_file\_fopen(char \*file, char \*mode):

Raydium wrapper to libc's `fopen` function.

This function will:

- Update some stats
- Try to download the file from repositories if no local version is found, or will try to update the file if asked (`--repository-refresh` or `repository-force`). See R3S on Raydium's Wiki.
- You can disable R3S client (for a "local only" file) adding a 'l' in `mode` ("rl" or "rbl" for example).
- Use Raydium paths (see suitable chapter)

### 22.9 unsigned long raydium\_file\_sum\_simple(char \*filename):

This function will generate a very simple checksum on `filename`.

### 22.10 unsigned long raydium\_file\_sum\_simple\_mode(char \*filename,char \*mode):

Same as above, but you can pass a fopen `mode` ("rt", or "rbl" for example).

See `raydium_file_fopen()` for more informations about `mode`.

### 22.11 char \* raydium\_file\_home\_path(char \*file):

This function will return an absolute file path for `file` in the home directory of the current user.

Returned value is a pointer to static memory. Do not free this memory and use it before any other call to this function, since it will be overwritten.

Example:

for `test.cfg`, this function will return `/home/me/.raydium/test.cfg`

See also `raydium_init_args_name()` if you want to tune this result.

**22.12 void raydium\_file\_home\_path\_cpy(char \*file, char \*dest):**

Same as above, but you must provide memory with `dest`.

**22.13 char \*raydium\_file\_load(char \*filename):**

This function loads `filename` (as a binary file under win32, no matter under Linux) in a string, and returns its address. You must free this memory when finished.

**23 Files (TRI format):****23.1 Warning:**

It's important to use only functions with `raydium_file_*` prefix.

All other functions may change or disappear. Upper level functions are available (see `object.c`).

**23.2 Introduction:**

`file.c` use `.tri` mesh files (text), available in 4 versions:

1. version 1: providing normals and uv texture mapping informations.
2. version 0: providing uv texture mapping.
3. version -1: only providing vertices.
4. version 2: mesh animation support

Version 1 example file:

```
1
5.1 15.75 -3.82 0.0000 0.0000 -1.0000 0.5158 0.5489 rgb(0.5,0.5,0.5)
6.3 11.75 -3.82 0.0000 0.0000 -1.0000 0.5196 0.5365 rgb(0.5,0.5,0.5)
5.0 11.75 -3.82 0.0000 0.0000 -1.0000 0.5158 0.5365 rgb(0.5,0.5,0.5)
...
```

You can find the file version on first line, and then data.

Next lines: vertex position (x,y,z), normal (x,y,z), texture mapping (u,v) and texture (string).

Version 2 files are a bit different, as showed below:

```
2
3 1743
0 39 stand
40 45 run
46 53 attack
1
5.1 15.75 -3.82 0.0000 0.0000 -1.0000 0.5158 0.5489 rgb(0.5,0.5,0.5)
6.3 11.75 -3.82 0.0000 0.0000 -1.0000 0.5196 0.5365 rgb(0.5,0.5,0.5)
5.0 11.75 -3.82 0.0000 0.0000 -1.0000 0.5158 0.5365 rgb(0.5,0.5,0.5)
...
```

You may have seen that headers are longer for v2 files. You'll find (just after the version number) how many "anims" are hosted by this file, and how many vertices are required for one frame. Then you'll find one line per "anim", with starting frame, ending frame and anim's name. Then starts a regular tri file ("sub-file", with its own version number) with ALL concatenated frames.

### 23.3 void dump\_vertex\_to (char \*filename):

This function save all scene to filename (.tri file) in version 1.

Vertice may be sorted.

Please, try to do not use this function.

### 23.4 void dump\_vertex\_to\_alpha (char \*filename):

Now useless and deprecated.

### 23.5 int raydium\_file\_set\_textures (char \*name):

Internal use.

This function analyze texture filename, and search for extended multitexturing informations (u,v and another texture).

### 23.6 void read\_vertex\_from (char \*filename):

Loads filename. Again, avoid use of this function.

## 24 File path:

### 24.1 Introduction:

No doc yet.

## 25 Camera:

### 25.1 Introduction:

Raydium provides camera management functions, allowing the coder to move camera with very simple functions, even for complex moves.

You have to place your camera once per frame (not more, not less).

"look\_at" style functions can be affected by `raydium_camera_look_at_roll` global variable, if needed.

A few words about camera path: Take a look to a .cam file if you want to understand this simple file format, but you probably only need the `cam.c` application, dedicated to camera path creation.

Some camera functions are provided by physics module, see suitable chapter.

### 25.2 void raydium\_camera\_vectors (GLfloat \* res3):

This function will return two vectors (2 \* 3 \* GLfloat), giving the camera orientation (front vector and up vector). At this day, the up vector is always the same as the world up vector, even if the camera is rotated or upside down (and yes, this MUST be corrected :).

Designed for internal uses, before all.

### 25.3 void raydium\_camera\_internal\_prepare(void):

Internal use. (pre)

### 25.4 void raydium\_camera\_internal (GLfloat x, GLfloat y, GLfloat z):

Internal use. (post)

### 25.5 void raydium\_camera\_place (GLfloat x, GLfloat y, GLfloat z, GLfloat lacet, GLfloat tangage, GLfloat roulis):

Sets the camera at (x,y,z) position, and using (lacet,tangage,roulis) as rotation angles.

**25.6 void raydium\_camera\_look\_at (GLfloat x, GLfloat y, GLfloat z, GLfloat x\_to, GLfloat y\_to, GLfloat z\_to):**

Sets the camera at (x,y,z) position, and looks at (x\_to,y\_to,z\_to).

**25.7 void raydium\_camera\_replace (void):**

You'll need to reset camera position and orientation after each object drawing.

If this is unclear to you, read the "example" section, below.

You will need to make your own 3D transformations (GLRotate, GLTranslate, ...) to draw your objects, or you can use the following function.

**25.8 void raydium\_camera\_replace\_go (GLfloat \* pos, GLfloat \* R):**

This function will replace the camera, as `raydium_camera_replace()`, but will place "3D drawing cursor" at position `pos` (3 GLfloat) with rotation `R` (4 GLfloat quaternion).

No eulers (rotx, roty, rotz) version of this function is provided for now..

Do you really need it ?

**25.9 Example of camera use:**

1. place camera
2. move "drawing cursor" to object's place
3. draw object
4. reset camera to initial place (the one given at step 1)
5. move "drawing cursor" to another object's place
6. draw another object
7. [...]

Steps 4 and 5 can be done with `raydium_camera_replace_go()`.

**25.10 void raydium\_camera\_rumble(GLfloat amplitude, GLfloat ampl\_evo, GLfloat secs):**

Camera (any type) will rumble for `secs` seconds, with `amplitude` (radians).

This `amplitude` will be incremented of `ampl_evo` every second (negative values are allowed for `ampl_evo`).

An `amplitude` is always positive.

**25.11 void raydium\_camera\_smooth (GLfloat px, GLfloat py, GLfloat pz, GLfloat lx, GLfloat ly, GLfloat lz, GLfloat zoom, GLfloat roll, GLfloat step):**

Smooth style clone of `raydium_camera_look_at`.

Roll is given by `roll` and not global variable `raydium_camera_look_at_roll` as for regular `look_at` function.

`zoom` is the requested FOV.

Play with `step` to modify smoothing level of the movement. A good way to use this function is the following usage :

```
raydium_camera_smooth(cam[0],cam[1],cam[2],pos[1],-pos[2],pos[0],70,0,raydium_frame_
```

**25.12 void raydium\_camera\_path\_init (int p):**

Internal use.

**25.13 void raydium\_camera\_path\_init\_all (void):**

Internal use.

**25.14 int raydium\_camera\_path\_find (char \*name):**

Lookups path's id using filename `name`.

This function will not try to load a camera path if it's not found, and will return -1.

### 25.15 int raydium\_camera\_path\_load (char \*filename):

Obvious : use this function to load a camera path.

### 25.16 void raydium\_camera\_path\_draw (int p):

Draws `p` camera path, as red lines. This must be done at each frame.

### 25.17 void raydium\_camera\_path\_draw\_name (char \*path):

Same as above, but using camera path's name.

### 25.18 signed char raydium\_camera\_smooth\_path (char \*path, GLfloat step, GLfloat \* x, GLfloat \* y, GLfloat \* z, GLfloat \* zoom, GLfloat \* roll):

Returns the (`x`, `y`, `z`) point of the camera path for step `step`, using provided `zoom` (FOV) and `roll` angle.

It's important to note that `step` is a float.

Mostly for internal use.

### 25.19 void raydium\_camera\_path\_reset(void):

Next smooth call will be instantaneous.

### 25.20 void raydium\_camera\_smooth\_path\_to\_pos (char \*path, GLfloat lx, GLfloat ly, GLfloat lz, GLfloat path\_step, GLfloat smooth\_step):

"Camera on path looking at a point".

Simple `raydium_camera_smooth` version: give a path name, a "look\_at"

point (`lx`, `ly`, `lz`), a current `path_step`, and a `smooth_step` time

factor (see `raydium_camera_smooth` example above).

### 25.21 void raydium\_camera\_smooth\_pos\_to\_path (GLfloat lx, GLfloat ly, GLfloat lz, char \*path, GLfloat path\_step, GLfloat smooth\_step):

"Camera on point looking at a path".

Same style as previous function.

### 25.22 void raydium\_camera\_smooth\_path\_to\_path (char \*path\_from, GLfloat path\_step\_from, char \*path\_to, GLfloat path\_step\_to, GLfloat smooth\_step):

"Camera on a path looking at another path".

Same style as previous functions.

## 26 Objects:

### 26.1 Introduction:

With the following functions, you can easily draw and manage mesh objects (.tri file).

### 26.2 GLint raydium\_object\_find (char \*name):

Lookups an object by its `name`. This function will return -1 if the object's not found, and will not try to load the .tri file.

### 26.3 signed char raydium\_object\_isvalid(int obj):

Internal use, but you can call this function if you want to verify if an object id is valid (in bounds).

### 26.4 GLint raydium\_object\_find\_load (char \*name):

Same as above (`raydium_object_load`), but will try to load object.

**26.5 void raydium\_object\_reset (GLuint o):**

Internal use. Do not call.

**26.6 int raydium\_object\_load (char \*filename):**

Load `filename` as a .tri file, and returns corresponding id, or -1 in case of error.

**26.7 void raydium\_object\_draw (GLuint o):**

Draws `o` (index) object, using current matrixes.

**26.8 void raydium\_object\_draw\_name (char \*name):**

Same as above, but you only have to provide object's `name` (".tri file"). If this object was not already loaded, this function will do it for you.

**26.9 void raydium\_object\_deform (GLuint obj, GLfloat ampl):**

Early devel state. Useless as is.

**26.10 void raydium\_object\_deform\_name (char \*name, GLfloat ampl):**

Early devel state. Useless as is.

**26.11 GLfloat raydium\_object\_find\_dist\_max (GLuint obj):**

This function will return will return the distance form (0,0,0) to the farrest point of `obj` object.

**26.12 void raydium\_object\_find\_axes\_max (GLuint obj, GLfloat \* tx, GLfloat \* ty, GLfloat \* tz):**

This function returns the (maximum) size of the bounding box of `obj` (relative to (0,0,0)).

**26.13 void raydium\_object\_find\_minmax(GLuint obj, GLfloat \*min, GLfloat \*max):**

Returns min and max values for `obj`. No memory allocation is done, you must provide two GLfloat[3] array.

**26.14 void raydium\_object\_find\_center\_factors(GLuint obj, GLfloat \*tx, GLfloat \*ty, GLfloat \*tz):**

Returns "centering" factors for `obj`. A centered object will return (0,0,0).

**26.15 void raydium\_object\_callback(void):**

Internal (frame callback).

**26.16 Animations:**

Raydium now supports mesh animation, thru MD2 (Quake 2) files. Raydium file format was extended to version 2. If you want to create an animated mesh for Raydium from a MD2 file, you may use Blender with "import-md2-0.14.py" script ( by Bob Holcomb, <http://67.22.114.230:8082/programming/blender/index.html> ) and export it back to a tri file using provided "triEXP-MD2-\*.py" script. All other tasks (loading, transformations, ...) are done the same way as regular static mesh.

For Raydium, an animation is a set of "anims", and each "anim" is a set of "frames". Each "anim" gets its own name (see header of a version 2 file for more informations), and since an animated object may be use for many players, Raydium provides an "instances" based system: setting things like anim and frame for an object is done only for one instance of this object. Instances are always available, no need to create or declare them. That's all you need to use animation simple API.

**26.17 GLint raydium\_object\_anim\_find(int object, char \*name):**

Lookups an animation by its `name`. This function will return -1 if the animation's not found. Mostly for internal use.

**26.18 void raydium\_object\_anim\_generate\_internal(int object, int instance):**

Internal. Transformed mesh generation.

**26.19 void raydium\_object\_anim\_frame(int object, int instance, GLfloat frame):**

Sets current `frame` for one `instance` of `object`. `frame` is automatically bounded and looped.

Warning, change anim before anim's frame.

**26.20 void raydium\_object\_anim\_frame\_name(char \*object, int instance, GLfloat frame):**

Same as above, but using `object`'s name.

**26.21 void raydium\_object\_anim(int object, int instance, int anim):**

Sets current `anim` for one `instance` of `object`.

Again, change anim before anim's frame.

**26.22 void raydium\_object\_anim\_name(char \*object, int instance, char \*anim):**

Same as above, but using `object`'s name and `anim`'s name.

**26.23 void raydium\_object\_anim\_instance(int object, int instance):**

With this function, you must set what instance will be drawn when `raydium_object_draw()` will be called with `object` argument.

Default is set to instance 0.

**26.24 void raydium\_object\_anim\_instance\_name(char \*object, int instance):**

Same as above, but using `object`'s name.

**26.25 void raydium\_object\_anim\_automatic(int object, int anim, GLfloat factor):**

With this function, you can set an automatic frame increment for a specific `anim` of an `object`. This increment is based on frame time and `factor`.

**26.26 void raydium\_object\_anim\_automatic\_name(char \*object, char \*anim, GLfloat factor):**

Same as above, but using `object`'s name and `anim`'s name.

**26.27 "Punctually" anims:**

When using animations, you're switching for an "anim" to another, and an "anim" will loop forever. "Punctually" support will allow you to set a default "anim" for an object and to do switch punctually to another "anim", and automatically return back to default value when this "anim" is finished, usefull for animations like jumps, kick, ...

**26.28 void raydium\_object\_anim\_default(int object, int anim):**

This function will set default `anim` for `object`.

**26.29 void raydium\_object\_anim\_punctually(int object, int anim, int instance):**

This function will trigger a punctually `anim` for `object`'s `instance`.

**26.30 void raydium\_object\_anim\_punctually\_name(char \*object, char \*anim, int instance):**

Same as above, but with object's name.

**26.31 signed char raydium\_object\_anim\_ispunctually(int object, int instance):**

Will return true (1) if `object` is currently running a punctually animation, or false (0) otherwise.

## 26.32 signed char raydium\_object\_anim\_ispunctually\_name(char \*object, int instance):

Same as above, but with object's name.

## 27 Initialization:

### 27.1 Introduction:

This file is mainly designed for internal uses, but there's anyway some interesting functions.

### 27.2 char \*raydium\_version(void):

Return Raydium Engine version as a static string. Format is "x.yyy". You can also find defines for this, named `RAYDIUM_MAJOR` (x) and `RAYDIUM_MINOR` (yyy).

### 27.3 void raydium\_init\_lights (void):

Internal use. Must be moved to light.c.

### 27.4 void raydium\_init\_objects (void):

Internal use. Must be moved to object.c.

### 27.5 void raydium\_init\_key (void):

Internal use. Must be moved to key.c.

### 27.6 void raydium\_init\_reset (void):

This function is supposed to reset the whole Raydium engine: textures, vertices, lights, objects, ...

Never tested yet, and probaly fails for many reasons when called more than one time.

### 27.7 void raydium\_init\_engine (void):

Internal use. Never call this function by yourself, it may cause huge memory leaks.

## 28 Command Line Interface:

### 28.1 Introduction:

Here, you'll find a few functions to deal with command line interface of Raydium.

### 28.2 int raydium\_init\_cli\_option(char \*option, char \*value):

This function will search command line `option`.

If this option is found, the functions stores any argument to `value` and returns 1.

The function will return 0 if `option` is not found.

Example (search for: `--ground`)

```
char model[RAYDIUM_MAX_NAME_LEN];
if(raydium_init_cli_option("ground",model))
{
setground(model);
}
```

### 28.3 int raydium\_init\_cli\_option\_default(char \*option, char \*value, char \*default\_value):

Same as above, but allows you to provide a default value (`default`) if the `option` is not found on command line.

#### 28.4 void raydium\_init\_internal\_homedir\_find(char \*):

Internal use.

#### 28.5 void raydium\_init\_args(int argc, char \*\*argv):

You must use this function, which send application arguments to Raydium and external libs (GLUT, [OpenAL](#), ...).

This must be done before any other call to Raydium.

Example:

```
int main(int argc, char **argv)
{
    raydium_init_args(argc, argv);
    [...]
}
```

#### 28.6 void raydium\_init\_args\_name(int argc, char \*\*argv, char \*app\_name):

Same as above, but with application short name. This string is used to build things like runtime configuration directory name (`~/.raydium/` by default).

Use this wrapper if you don't want to share your configuration with Raydium.

## 29 Signals:

### 29.1 Quickview:

There almost nothing to said about signals management, except that Raydium will try to catch SIGINT signal (sended by CTRL+C sequence, for example).

There's nothing else for now, but we plan a user callback for this signal.

## 30 Sound and music:

### 30.1 Introduction:

The Raydium sound API is pretty easy to use and there's only need to use a few functions to make your program ouput sounds or music.

On top of this, there are a bunch of functions to modify the sound behavior.

Raydium uses [OpenAL](#) and [OggVorbis?](#) for its sounds and musics, for a basic use of our sound API you only need to know one thing: [OpenAL](#) uses buffers for its sounds and you need to be able to address the sounds separately. For this we use `ALuint` in our code. Each buffer is associated to a source, we have an array of all available sources and then, you only need to have a simple `int` that acts as an index in this array. See below for more informations.

Music is readed thru `libogg`, streamed from disk. If you want to play an OGG audio track, the only thing you've to do is to call the suitable function. You can use `raydium_sound_music_eof_callback` if needed. This event is fired when sound track ends, allowing you to switch to another file. Prototype for this callback is `int callback(char *new_track)`, allowing you to do something like `strcpy(new_track, "foobar.ogg"); return 1;` Return 0 if you do not want to switch to another audio file (this will stops music playback).

Another callback is available, `raydium_sound_music_changed_callback`, fired just after a music track switch, allowing you to get new informations from the new stream, such as artist, album and title. See `raydium_sound_load_music()`

for more informations about this.

This document is not an alternative to [OpenAL](#) papers, and only provides informations about Raydium's interface to [OpenAL](#).

See specifications here: <http://www.openal.org/documentation.html>

### **30.2 void raydium\_sound\_verify (char \*caller):**

This functions checks if any error occurred during last [OpenAL](#) operation. You don't have to call this function by yourself, since every function of this API will do it.

### **30.3 int raydium\_sound\_Array3IsValid(ALfloat \*a):**

Since [OpenAL](#) is very sensitive to malformed values, this function is used internally to check consistency of provided ALfloat arrays.

### **30.4 void raydium\_sound\_InitSource (int src):**

Internal use.

### **30.5 int raydium\_sound\_LoadWav (const char \*fname):**

This function tries to load the `fname` wav file into a buffer, if successful, it returns the source id, else 0.

### **30.6 int raydium\_sound\_SourceVerify (int src):**

Internal id checks.

### **30.7 int raydium\_sound\_SetSourceLoop (int src, signed char loop):**

Modifies the `loop` property of the `src` source (loops if loop is non-zero, default value for a source is "true"). Returns 0 if ok, -1 if error.

### **30.8 int raydium\_sound\_GetSourcePitch (int src, ALfloat \* p):**

Returns current pitch for `src` source.

### **30.9 int raydium\_sound\_SetSourcePitch (int src, ALfloat p):**

Sets pitch for `src` source.

Current [OpenAL](#) spec is not clear about pitch's limits. Raydium will clamp values to to ]0,2] interval.

### **30.10 int raydium\_sound\_GetSourceGain (int src, ALfloat \* g):**

Returns current gain ("volume") for `src` source.

### **30.11 int raydium\_sound\_SetSourceGain (int src, ALfloat g):**

Sets gain ("volume") for `src` source.

Current [OpenAL](#) spec is not clear about pitch's limits. Raydium do not allows negative values, but no upper limit is set.

Warning: some [OpenAL](#) implementations will provide strange gain curves. More work is needed on this issue.

### **30.12 int raydium\_sound\_SetSourcePos (int src, ALfloat Pos[]):**

Sets 3D position of `src` source.

`Pos` is a 3 \* ALfloat array.

### **30.13 int raydium\_sound\_SetSourcePosCamera(int src):**

Sets 3D position of `src` source on the current camera position.

### **30.14 int raydium\_sound\_GetSourcePos (int src, ALfloat \* Pos[]):**

Returns current 3D position of `src` source.

`Pos` is a 3 \* ALfloat array.

### **30.15 int raydium\_sound\_SetSourceDir (int src, ALfloat Dir[]):**

Sets 3D direction of `src` source.

`Dir` is a 3 \* ALfloat array.

### **30.16 int raydium\_sound\_GetSourceDir (int src, ALfloat \* Dir[]):**

Returns current 3D direction of `src` source.

`Dir` is a 3 \* ALfloat array.

### **30.17 int raydium\_sound\_SetSourceVel (int src, ALfloat Vel[]):**

Sets 3D velocity of `src` source.

`Vel` is a 3 \* ALfloat array.

### **30.18 int raydium\_sound\_GetSourceVel (int src, ALfloat \* Vel[]):**

Returns current 3D velocity of `src` source.

`Vel` is a 3 \* ALfloat array.

### **30.19 void raydium\_sound\_SetListenerPos (ALfloat Pos[]):**

Sets 3D position of listener.

This is done automatically by Raydium, each frame, using camera informations

`Pos` is a 3 \* ALfloat array.

### **30.20 void raydium\_sound\_GetListenerPos (ALfloat \* Pos[]):**

Returns current 3D position of listener.

`Pos` is a 3 \* ALfloat array.

### **30.21 void raydium\_sound\_SetListenerOr (ALfloat Or[]):**

Sets 3D orientation of listener.

This is done automatically by Raydium, each frame, using camera informations

`Or` is a 3 \* ALfloat array.

### **30.22 void raydium\_sound\_GetListenerOr (ALfloat \* Or[]):**

Returns current 3D orientation of listener.

`Or` is a 3 \* ALfloat array.

### **30.23 void raydium\_sound\_SetListenerVel (ALfloat Vel[]):**

Sets 3D velocity of Listener.

`Vel` is a 3 \* ALfloat array.

### **30.24 void raydium\_sound\_GetListenerVel (ALfloat \* Vel[]):**

Returns current 3D velocity of Listener.

`Vel` is a 3 \* ALfloat array.

### **30.25 void raydium\_sound\_init (void):**

Internal use.

### **30.26 int raydium\_sound\_SourcePlay (int src):**

Plays the `src` source.

If `src` was already in "play" state, the buffer is rewinded.

Returns 0 if ok, -1 if error.

### **30.27 int raydium\_sound\_SourceStop (int src):**

Stops the `src` source.

Returns 0 if ok, -1 if error.

### **30.28 int raydium\_sound\_SourcePause (int src):**

Will pause the `src` source.

Returns 0 if ok, -1 if error.

### 30.29 int raydium\_sound\_SourceUnpause (int src):

`src` will restart playback after being paused.

Returns 0 if ok, -1 if error.

### 30.30 signed char raydium\_sound\_IsPlaying(int src):

Returns true (1) if `src` is playing, false (0) if stopped or invalid.

### 30.31 void raydium\_sound\_close (void):

Internal use.

### 30.32 int raydium\_sound\_load\_music (char \*fname):

Opens fname OGG music file and prepares Raydium for playing it.

The music will be automatically played after a call to this function.

This function will use R3S (data repositories) if needed.

To switch to another audio track, simply call again this function.

Send `NULL` or an empty string to cancel music playback.

Returns 0 if ok, -1 if error

See also `raydium_sound_music_eof_callback` at the top of this chapter.

You can get OGG informations from `raydium_sound_music_info`, using its members:

```
char artist[RAYDIUM_MAX_NAME_LEN];
char title [RAYDIUM_MAX_NAME_LEN];
char album [RAYDIUM_MAX_NAME_LEN];
```

### 30.33 void raydium\_sound\_music\_info\_init(void):

Internal use. Will reset infos.

### 30.34 void raydium\_sound\_music\_info\_refresh(void):

Internal use. Will flush infos from disk to `raydium_sound_music_info`.

### 30.35 void raydium\_sound\_music\_callback (void):

Internal use.

### 30.36 void raydium\_sound\_callback (void):

Internal use.

### 30.37 void raydium\_sound\_source\_fade(int src, ALfloat len):

This function will fade down source `src` over `len` seconds.

Since gain is not linear, you may have to play a bit with `len` to find the correct value for you.

Use source 0 for music source.

### 30.38 Sound API Example:

```
int sound;
sound=raydium_sound_LoadWav( "explo.wav" );
raydium_sound_SetSourceLoop( sound, 0 );
[ ... ]
if(explosion) raydium_sound_SourcePlay(sound);
```

### 30.39 void raydium\_sound\_source\_fade\_to(int src, ALfloat len, char \*to):

Same as above, but plays `to` file at the end of the fade.

Warning: Works only for "music" source (`src = 0`).

## 31 Timecalls:

### 31.1 Concept:

As you may already know, in a real time application (as a game), you need to control in-game time evolution.

For example, you cannot increment a car position by 1 at each frame since it will generate an irregular scrolling (a frame is never rendered within the same time as the previous or the next one).

Raydium supports timecalls, which are a great solution for this problem.

Usage is very simple: write a simple function, and ask Raydium to call it at the desired rate.

### 31.2 Constraints:

There is an important risk with timecalls: infinite loops.

If a callback is long, it may take more CPU time than he would, as in this very simple example:

`foo()` is a function, taking 200 ms for his own execution. If you ask for a 6 Hz execution, Raydium will execute `foo()` six times on the first frame, taking 1200 ms. On the next frame, Raydium will need to execute `foo()` 7 times (the asked 6 times, and one more for the 200 ms lost during the last frame), taking 1400 ms, so 8 times will be needed for the next frame, then 9, ...

So you need to create callbacks as short as possible, since long callbacks may cause a game freeze on slower machines than yours. (1 FPS syndrom)

### 31.3 Hardware devices and methods:

Raydium must use a very accurate system timer, and will try many methods:

`/dev/rtc`, `gettimeofday()` (Linux only) and

`QueryPerformanceCounter?` for win32.

`gettimeofday()` will use a CPU counter and is extremely accurate.

It's far the best method. (0.001 ms accuracy is possible)

`/dev/rtc` is quite good, and Raydium will try to configure RTC at `RAYDIUM_TIMECALL_FREQ_PREFERRED` rate (8192 Hz by default), but may require a `"/proc/sys/dev/rtc/max-user-freq"` modification:  
`echo 8192 > /proc/sys/dev/rtc/max-user-freq`

You may want to look at `common.c` for interesting defines about timecalls.

### 31.4 void raydium\_timecall\_raydium (GLfloat step):

Internal Raydium callback.

**31.5 float raydium\_timecall\_internal\_w32\_detect\_modulo(int div):**

Internal, WIN32 only: Returns timer resolution for `div` divisor.

**31.6 int raydium\_timecall\_internal\_w32\_divmodulo\_find(void):**

Internal, WIN32 only: Detects the best timer divisor for the current CPU.

**31.7 unsigned long raydium\_timecall\_devrtc\_clock (void):**

Internal, Linux only: Reads and return RTC clock.

**31.8 unsigned long raydium\_timecall\_clock (void):**

Returns current "time".

**31.9 signed char raydium\_timecall\_devrtc\_rate\_change (unsigned long new\_rate):**

Internal, Linux only: Modifies RTC clock rate.

**31.10 void raydium\_timecall\_devrtc\_close (void):**

Internal, Linux only: Will close RTC clock.

**31.11 unsigned long raydium\_timecall\_devrtc\_init (void):**

Internal, Linux only: Will open RTC clock.

**31.12 int raydium\_timecall\_detect\_frequency (void):**

Internal: This function will find the best timer available for current platform, and adjust properties to your hardware (rate, divisor, ...).

**31.13 void raydium\_timecall\_init (void):**

Internal use.

**31.14 int raydium\_timecall\_add (void \*funct, GLint hz):**

There is two sort of timecalls with Raydium:

1. Standard ones:

```
raydium_timecall_add(function, 800);
```

`void function(void)` will be called 800 times per second.

2. Elastic timed ones:

```
raydium_timecall_add(function, -80);
```

`void function(float step)` will be called for each frame, with a "step factor" as argument. In the above example, a 160 Hz game will call function with `step = 0.5`, but `step = 2.0` for a 40 Hz game.

A standard timecall will use `void(void)` function and a positive `hertz` argument, as an elastic one will use `void(float)` and negative `hertz` argument.

**31.15 void raydium\_timecall\_freq\_change (int callback, GLint hz):**

This function changes the `callback` frequency. See above for possibles values of `hz` (negative and positive values).

**31.16 void raydium\_timecall\_callback (void):**

Internal use (frame fired callback).

## 32 Network:

### 32.1 Bases of Raydium's networking API:

Raydium supports networking via UDP/IP, providing high level functions for multiplayer game development.

Raydium servers are limited to 256 clients for now.

You will find in network.c a set of "low level" functions and vars dedicated to networked games: players names, event callbacks, UDP sockets, broadcasts, ...

See a few chapters below for higher level functions.

All this is ready to use. As it's not done in the introduction of this guide, We will explain here some variables defined in common.h.

```
#define RAYDIUM_NETWORK_PORT          29104
#define RAYDIUM_NETWORK_PACKET_SIZE  230
#define RAYDIUM_NETWORK_TIMEOUT      5
#define RAYDIUM_NETWORK_PACKET_OFFSET 4
#define RAYDIUM_NETWORK_MAX_CLIENTS  8
#define RAYDIUM_NETWORK_MODE_NONE    0
#define RAYDIUM_NETWORK_MODE_CLIENT  1
#define RAYDIUM_NETWORK_MODE_SERVER  2
```

Here, we can find network port declaration (Raydium will use only one port, allowing easy port forwarding management, if needed), default timeout (unit: second), and the three mode possible for a Raydium application.

But there is also two other very important defines: packet size (unit: byte) and max number of clients.. This is important because Raydium uses UDP sockets, and UDP sockets required fixed length packets, and as you need to set packet size as small as possible (for obvious speed reasons), you must calculate you maximum information packet size (players position, for example), multiply it by `RAYDIUM_NETWORK_MAX_CLIENTS`, and add `RAYDIUM_NETWORK_PACKET_OFFSET` wich represent the required header of the packet.

It's more easy than it seems, look:

My game will support 8 players.

I will send players state with 3 floats (x,y,z).

My packet size must be:  $8 * 3 * \text{sizeof(float)} + \text{RAYDIUM\_NETWORK\_PACKET\_OFFSET} = 100$  bytes.

Please, do not change packet offset size, since Raydium will use it for packet header.

```
#define RAYDIUM_NETWORK_DATA_OK      1
#define RAYDIUM_NETWORK_DATA_NONE   0
#define RAYDIUM_NETWORK_DATA_ERROR -1
```

This three defines are used as network functions result:

```

if(raydium_network_read_flushed(&id,&type,buff)==RAYDIUM_NETWORK_DATA_OK)
{
...

```

```

#define RAYDIUM_NETWORK_PACKET_BASE 20

```

In most network functions, you will find a "type" argument, used to determine packet goal. This type is 8 bits long (256 possible values), but Raydium is already using some of them. So you can use [RAYDIUM\\_NETWORK\\_PACKET\\_BASE](#) as a base for your own types:

```

#define NORMAL_DATA RAYDIUM_NETWORK_PACKET_BASE
#define BALL_TAKEN (NORMAL_DATA+1)
#define SCORE_INFO (NORMAL_DATA+2)
#define HORN (NORMAL_DATA+3)
...

```

#### Variables:

Your own player id ( $0 \leq id < \text{RAYDIUM\_NETWORK\_MAX\_CLIENTS}$ ),  
read only: `int raydium_network_uid;`  
Special value "-1" means that you're not connected (see below).

Current network mode (none, client, server),  
read only: `signed char raydium_network_mode;`

Boolean used to determine client state (connected or not), read only:  
`signed char raydium_network_client[RAYDIUM_NETWORK_MAX_CLIENTS];`

example:

```

if(raydium_network_client[4])
draw_player(4);

```

Can be used by a server to send data to his clients. Read only:  
`struct sockaddr raydium_network_client_addr[RAYDIUM_NETWORK_MAX_CLIENTS];`

Players names, read only:  
`char raydium_network_name[RAYDIUM_NETWORK_MAX_CLIENTS][RAYDIUM_MAX_NAME_LEN];`

[OnConnect?](#) and [OnDisconnect?](#) events (server only):

```

void * raydium_network_on_connect;
void * raydium_network_on_disconnect;

```

You can place your owns callbacks (`void(int)`) on these events, as in this example:

```

void new_client(int client)
{
raydium_log("New player: %s", raydium_network_nameclient);
}

...

int main(int argc, char **argv)
{
...
raydium_network_on_connect=new_client;
...
}

```

### 32.2 Reliability versus Speed:

As explained above, Raydium is using UDP network packets, and as you may know, UDP is not a reliable protocol, aiming speed before all.

This system is interesting for sending non-sensible data, as player positions, for example.

But Raydium can handle more important data, using some of methods of TCP protocol, as Timeouts, ACK, resending, ...

This TCP style packets are available thru "Netcalls".

### 32.3 High level API: "Netcalls" and "Propags":

Netcalls provides you a good way to handle network exchanges using callbacks functions, like a simple RPC system.

The idea is simple, built over the notion of "type". See suitable functions for more information about this system.

Another available mechanism is called Propags, and allows you to "share" variables over the network (scores, game state, ...) in a very few steps.

You only need to "create" a type, and link a variable to it (any C type or structure is allowed). After each modification of this (local copy of the) variable, just call `raydium_network_propag_refresh*` and that's it. If any other client (or the server) is applying a modification to this "type", your local copy is automatically updated.

### 32.4 int raydium\_network\_propag\_find (int type):

Lookups a "propag" by his `type`. Returns -1 is no propag is found.

### 32.5 void raydium\_network\_propag\_recv (int type, char \*buff):

Internal callback for "propag" receiving.

### 32.6 void raydium\_network\_propag\_refresh\_id (int i):

Will refresh a propag by his `id`.

### 32.7 void raydium\_network\_propag\_refresh (int type):

Will refresh a propag by his `type`.

### 32.8 void raydium\_network\_propag\_refresh\_all (void):

Will refresh all propags

### 32.9 int raydium\_network\_propag\_add (int type, void \*data, int size):

This function will "register" a new propag. You need to provide the address of your variable/structure (`data`), and its `size`. A dedicated `type`

is also required (see at the top of this chapter).

### **32.10 void raydium\_network\_queue\_element\_init (raydium\_network\_Tcp \* e):**

Internal use. (TCP style packets)

### **32.11 unsigned short raydium\_network\_queue\_tcpid\_gen (void):**

Internal use. (TCP style packets)

### **32.12 void raydium\_network\_queue\_tcpid\_known\_add (int tcpid, int player):**

Internal use. (TCP style packets)

### **32.13 signed char raydium\_network\_queue\_tcpid\_known (unsigned short tcpid, unsigned short player):**

Internal use. (TCP style packets)

### **32.14 signed char raydium\_network\_queue\_is\_tcpid (int type):**

Internal use. (TCP style packets)

### **32.15 void raydium\_network\_queue\_element\_add (char \*packet, struct sockaddr \*to):**

Internal use. (TCP style packets)

### **32.16 unsigned long \*raydium\_network\_internal\_find\_delay\_addr (int player):**

Internal use. (TCP style packets)

### **32.17 void raydium\_network\_queue\_check\_time (void):**

Internal use. (TCP style packets)

### **32.18 void raydium\_network\_queue\_ack\_send (unsigned short tcpid, struct sockaddr \*to):**

Internal use. (TCP style packets)

### **32.19 void raydium\_network\_queue\_ack\_recv (int type, char \*buff):**

Internal use. (TCP style packets)

### **32.20 void raydium\_network\_player\_name (char \*str):**

This function will returns the current player name.

Raydium will ask the OS for "current logged user", but player name may be provided thru `--name` command line argument.

### **32.21 signed char raydium\_network\_set\_socket\_block (int block):**

This function will sets `block` (true or false) status to the network stack.

A blocking socket will wait indefinitely an incoming packet. A non blocking one will return "no data" instead.

You've almost no reason to call this function by yourself.

### **32.22 int raydium\_network\_socket\_close(int fd):**

Portable socket closing function. See "man 2 close" or `closesocket (win32)` docs.

### **32.23 signed char raydium\_network\_socket\_is\_readable(int fd):**

Will return true (1) if there is some data ready on `fd` socket, false (0) otherwise.

### **32.24 signed char raydium\_network\_netcall\_add (void \*ptr, int type, signed char tcp):**

This function will register a new Network Callback ("netcall").

With Raydium, you can read the main data stream with

`raydium_network_read_flushed()`, and configure netcalls on random events (using packet type).

Netcalls signature is: `void(int type, char *buff)`

As you may configure the same callback function for multiples packet types, this type is passed to your function, with the temporary `buff` buffer.

You can extract from field from packet if needed.

If you sets the `tcp` flag to true (1), your packet will use "TCP style" network protocol (see a the top of this chapter).

### 32.25 void raydium\_network\_netcall\_exec (int type, char \*buff):

Internal callback for "netcall" receiving.

### 32.26 signed char raydium\_network\_timeout\_check (void):

Internal use.

### 32.27 void raydium\_network\_init\_sub(void):

Internal use.

### 32.28 signed char raydium\_network\_init (void):

Nothing interesting unless you're creating a console server (using the `RAYDIUM_NETWORK_ONLY` directive), since in this case you must do all inits by yourself...

example :

```
#define RAYDIUM_NETWORK_ONLY
#include "raydium/index.c"

...

int main(int argc, char **argv)
{
    setbuf(stdout, NULL);
    signal(SIGINT, quit);
    raydium_php_init(); // only if you need PHP support
    raydium_network_init();
    raydium_network_server_create();
    ...
}
```

### 32.29 void raydium\_network\_write (struct sockaddr \*to, int from, signed char type, char \*buff):

Obviously, this function will send data.

If you're a client, you don't need to determine to field, as the only destination is the server, so you can use `NULL`, for example. If you're a server, you can use `raydium_network_client_addr[]` array.

As a client, `from` argument is generally your own uid (`raydium_network_uid`), but you can use any other player number if needed.

As a server, `from` field is useless, since you are the only machine able to send data to clients.

As you may expect, `type` field is used to determine packet's type.

You can use any (8 bits) value greater or equal to `RAYDIUM_NETWORK_PACKET_BASE`.

Finally, `buff` is a pointer to data's buffer. This buffer must be `RAYDIUM_NETWORK_PACKET_SIZE` long, and can be cleared

or re-used after this call.

### **32.30 void raydium\_network\_broadcast (signed char type, char \*buff):**

Sends data over network.

Obviously, from network point of vue, only a server can broadcast (to his clients).

When a client needs to broadcast (from the game point of vue) some informations (his own position, for example), he must send this information to server, and the server will broadcast it.

This function uses the same arguments as previous one, except `to` and `from`, not needed here.

### **32.31 signed char raydium\_network\_read (int \*id, signed char \*type, char \*buff):**

Reads next packet from network (FIFO) stack.

This function uses the same arguments as previous ones, and returns data availability: `RAYDIUM_NETWORK_DATA_OK`, `RAYDIUM_NETWORK_DATA_NONE` or `RAYDIUM_NETWORK_DATA_ERROR`.

### **32.32 signed char raydium\_network\_read\_flushed (int \*id, signed char \*type, char \*buff):**

Reads last packet from network stack.

All previous packets will be ignored, only the newest packet will be read (if any).

As you may miss some important informations, you can use netcalls (see above) if you want to capture packets with a particular type, even with flushed reading.

### **32.33 void raydium\_network\_read\_faked(void):**

Reads from network, but do not care of received data. This is useful for listen to internal packets (server "beacon" broadcasts, for example).

Reading is done thru `raydium_network_read_flushed`.

Mostly for internal use.

### **32.34 signed char raydium\_network\_server\_broadcast(char \*name, char \*app\_or\_mod, int version):**

This function will start to broadcast a server to the LAN.

You must provide a party `name`, the application or mod name (`app_or_mod`) and a "protocol" version of you choice.

The server is going to broadcast a "beacon" packet to the LAN every `RAYDIUM_NETWORK_BEACON_DELAY`.

Any client in "discovery mode" with the same `app_or_mod` and `version` will see this beacon.

### **32.35 void raydium\_network\_server\_broadcast\_info(char \*info):**

Update "information" field of this server (current track or map, for example).

Size cannot exceed `RAYDIUM_NETWORK_BEACON_INFO_MAX_LEN`.

### **32.36 void raydium\_network\_server\_broadcast\_check(void):**

Internal use.

### **32.37 signed char raydium\_network\_server\_create (void):**

Will transform you application into a server, accepting new clients instantaneously.

See also the `RAYDIUM_NETWORK_ONLY` directive if you want to create console servers.

**32.38 signed char raydium\_network\_client\_connect\_to (char \*server):**

This function will try to connect your application to `server` (hostname or ip address).

WARNING: For now, this call could be endless ! (server failure while connecting).

This function will succeed returning 1 or 0 otherwise.

You are connected instantaneously, and you must start sending data before server timeout (defined by `RAYDIUM_NETWORK_TIMEOUT`).

You player number can be found with `raydium_network_uid` variable, as said before.

**32.39 signed char raydium\_network\_client\_discover(char \*game,int version):**

This function will set client in `RAYDIUM_NETWORK_MODE_DISCOVER` mode.

While using this mode, a client will search every LAN server with the same `game` (or mod name) and `version` as itself.

Then, you can access to this server list using [undocumented yet].

**32.40 int raydium\_network\_discover\_numservers(void):**

While the client is in `RAYDIUM_NETWORK_MODE_DISCOVER` mode, you can fetch all "detected" servers in the LAN.

This function will return :

- -1 : "not in discovery mode". See `raydium_network_client_discover()`.
- 0 : no server detected (yet ... try during next frame)
- more : total number of compatible servers (same game/application and protocol version)

**32.41 signed char raydium\_network\_discover\_getserver(int num, char \*name, char \*ip, char \*info, int \*player\_count, int \*player\_max):**

Use this function with the help of `raydium_network_discover_numservers()`, with something like :

```
int i;
char name[RAYDIUM_MAX_NAME_LEN];
char ip[RAYDIUM_MAX_NAME_LEN];
char info[RAYDIUM_MAX_NAME_LEN];
int player_count;
int player_max;
...
for(i=0;i<raydium_network_discover_numservers();i++)
{
raydium_network_discover_getserver(i,name,ip,info,&player_count,&player_max);
raydium_log("server %02i: %s (%s)",i,name,ip);
}
```

No memory allocation is done for `##name##` and `##ip##`. It's your job.

This function will return :

- -1 : "not in discovery mode". See `##raydium_network_client_discover()##`.
- 0 : invalid `##num##`.
- 1 : OK.

**32.42 void raydium\_network\_client\_disconnect(void):**

This function will disconnect client from server, if connected.

**32.43 signed char raydium\_server\_accept\_new (struct sockaddr \*from, char \*name):**

Internal server callback for new clients.

**32.44 void raydium\_network\_close (void):**

Obvious. Raydium will do it for you, anyway.

**32.45 void raydium\_network\_internal\_server\_delays\_dump (void):**

Dumps "TCP Style" timeouts for all clients to console.

**32.46 void raydium\_network\_internal\_dump (void):**

Dumps various stats about network stack to console.

**32.47 signed char raydium\_network\_internet\_test(void):**

This function will test if direct internet connection is available, using Raydium webiste. This function supports proxies.

**32.48 signed char raydium\_network\_linux\_find\_broadcast\_interfaces(void):**

Internal use. Linux only.

**33 OSD (On Screen Display):****33.1 Introduction:**

Raydium provides some high level function for "On Screen Display", as string drawing (2D and 3D), application's logo, mouse cursor, and other various 2D displaying tools.

In most cases, these functions must be called after any other object drawing function, to avoid overlapping problems.

Most functions will use a percentage system, and origin is at lower-left corner.

**33.2 void raydium\_osd\_color\_change (GLfloat r, GLfloat g, GLfloat b):**

This function will change the font color for the next `raydium_osd_printf*` calls.

As usual:  $0 \leq (r, g \text{ and } b) \leq 1$ .

**33.3 void raydium\_osd\_alpha\_change (GLfloat a):**

Same as above, but will change font transparency.

**33.4 void raydium\_osd\_color\_rgba (GLfloat r, GLfloat g, GLfloat b, GLfloat a):**

This is a mix of `raydium_osd_color_change` and `raydium_osd_alpha_change`.

**33.5 void raydium\_osd\_color\_ega (char hexa):**

This function will change font color with the corresponding hexadecimal code (as a char: '0' to 'F') in the standard EGA palette.

Here is this palette:

Hexa	Color
0	Black
1	Blue
2	Green
3	Cyan
4	Red
5	Purple
6	Brown
7	White
8	Grey

9	Light Blue
A	Light Green
B	Light Cyan
C	Light Red
D	Light Purple
E	Light Yellow
F	Light White

**33.6 void raydium\_osd\_start (void):**

Mostly for internal uses. (will configure screen for OSD operations)

**33.7 void raydium\_osd\_stop (void):**

Mostly for internal uses. (see above)

**33.8 void raydium\_osd\_draw (int tex, GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2):**

Will draw `tex` texture using `(x1,y1)` and `(x2,y2)` points.

**33.9 void raydium\_osd\_draw\_name (char \*tex, GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2):**

Same as above, but using texture filename.

**33.10 void raydium\_osd\_printf (GLfloat x, GLfloat y, GLfloat size, GLfloat spacer, char \*texture, char \*format, ...):**

This function is an [OpenGL](#) equivalent to the standard "printf" C function.

- `(x,y)` is the position of the text's beginning, as a screen percentage, with origin at lower left.

- `size` is the font size, using an arbitrary unit. This size is always proportionnal to frame size (font size will grow up with screen size, in other words).

- `spacer` is the factor of spacing between 2 consecutive letters. With standard fonts, 0.5 is a correct value (relatively condensed text).

- `texture` is obviously the texture filename to use (font\*.tga are often provided with Raydium distribution, and by R3S).

- `format` is the standard printf format string, followed by corresponding arguments: `^9Player ^Fname is: %10s`, `player_name`  
This format can use '^' char to change color text, followed by a color, indicated by a hexadecimal letter (EGA palette). See `raydium_osd_color_ega` function, above.

Here you are a simple example:

```
strcpy(version, "^Ctest 0.1^F");
raydium_osd_printf(2,98,16,0.5, "font2.tga", "- %3i FPS - tech demo %s for Raydium %s",
raydium_render_fps, version, raydium_version);
```

**33.11 void raydium\_osd\_printf\_3D (GLfloat x, GLfloat y, GLfloat z, GLfloat size, GLfloat spacer, char \*texture, char \*format, ...):**

Same as above, but you can place your text in your application 3D space, using `x`, `y` and `z` values.

### 33.12 void raydium\_osd\_logo (char \*texture):

Will draw a logo for the current frame with texture filename.  
For now, you've no control over rotation speed of the logo.

### 33.13 void raydium\_osd\_cursor\_set (char \*texture, GLfloat xsize, GLfloat ysize):

This function will set mouse cursor with texture filename and with (`xsize`,`ysize`) size (percent of screen size).  
You should use a RGBA texture for better results.  
example:

```
raydium_osd_cursor_set ( "BOXcursor.tga" , 4 , 4 ) ;
```

You can set `texture` to NULL or empty string to cancel OSD cursor texture.

### 33.14 void raydium\_osd\_cursor\_draw (void):

Internal use.

### 33.15 void raydium\_osd\_internal\_vertex (GLfloat x, GLfloat y, GLfloat top):

Internal use.

### 33.16 void raydium\_osd\_network\_stat\_draw (GLfloat px, GLfloat py, GLfloat size):

Will draw network stats (if available) in a box.

```
raydium_osd_network_stat_draw(5, 30, 20) ;
```

### 33.17 void raydium\_osd\_mask (GLfloat \* color4):

Will draw a uniform mask using `color4` (RGBA color) for this frame.

### 33.18 void raydium\_osd\_mask\_texture(int texture,GLfloat alpha):

Will draw a textured mask, with `alpha` opacity (1 is full opacity).

### 33.19 void raydium\_osd\_mask\_texture\_name(char \*texture,GLfloat alpha):

Same as above, but resolving texture by name.

### 33.20 void raydium\_osd\_mask\_texture\_clip(int texture,GLfloat alpha, GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2):

Same as `raydium_osd_mask_texture`, but (`x1`,`y1`),(`x2`,`y2`) will be used as texture coords, in a [0,100] range.

### 33.21 void raydium\_osd\_mask\_texture\_clip\_name(char \*texture,GLfloat alpha, GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2):

Same as above, but resolving texture by name.

### 33.22 void raydium\_osd\_fade\_callback (void):

Internal use.

### 33.23 void raydium\_osd\_fade\_init (void):

Internal use.

### 33.24 void raydium\_osd\_fade\_from (GLfloat \* from4, GLfloat \* to4, GLfloat time\_len, void

**\*OnFadeEnd?):**

This function will configure a fading mask from `from4` color to `to4`.

This fade will last `time_len` seconds, and will call `OnFadeEnd?` callback when finished.

This callback signature must be `void callback(void)`.

A standard fade-to-black-and-restore example:

```
// back to normal rendering
void restorefade(void)
{
  GLfloat from[4]={0,0,0,2};
  GLfloat to[4]={0,0,0,0};
  raydium_osd_fade_from(from,to,1,NULL);
  // do things (like moving camera to another place, for example).
}

...

// If space key : fade to black
if(raydium_key_last==1032)
{
  GLfloat from[4]={0,0,0,0};
  GLfloat to[4]={0,0,0,1};
  raydium_osd_fade_from(from,to,0.3,restorefade);
}
```

## 34 In-game console:

### 34.1 Introduction:

This chapter introduce Raydium console, allowing applications to take user keyboard input (game commands, chat, ...) and to send informations to this console.

The end user can call the console using "the key below esc".

By default, if PHP support is enabled, all user commands will be redirected to PHP engine. Each command will get his own context, don't expect to create anything else than "single line PHP scripts" with the console. See PHP chapter for more informations.

The console allows the user to prefix command with the following characters:

- /: Non PHP command. The command will be sent to application (see `raydium_console_gets_callback`, below).
- >: Will launch argument as a PHP script (identical to `include("...")`)
- !: Will launch argument as a sequence script

Command history is saved to `raydium_history` file when application exits.

You can use a `void prompt(char *)` callback to get user commands. Your callback must be registered thru `raydium_console_gets_callback`:

```
raydium_console_gets_callback=prompt;
```

This console provides auto-completion of register functions and variables.  
See the suitable chapter for more information.

#### 34.2 void raydium\_console\_init (void):

Internal use.

#### 34.3 void raydium\_console\_history\_save (void):

Internal use (will flush console history to disk).

You can call it by yourself if needed.

#### 34.4 int raydium\_console\_gets (char \*where):

DISABLED.

Use [raydium\\_console\\_gets\\_callback](#) function pointer instead.

#### 34.5 void raydium\_console\_history\_previous (void):

Internal use.

#### 34.6 void raydium\_console\_history\_next (void):

Internal use.

#### 34.7 void raydium\_console\_history\_add (char \*str):

Internal use.

#### 34.8 void raydium\_console\_exec\_script (char \*file):

Internal use.

#### 34.9 void raydium\_console\_exec\_last\_command (void):

Internal use.

#### 34.10 void raydium\_console\_line\_add (char \*format, ...):

Mostly reserved for internal use, but unless [raydium\\_log](#), this function will add the provided data only to ingame console, and not to "native" console.

#### 34.11 int raydium\_console\_history\_read(char \* \*hist):

This function will build an history list.

See this example :

```
char *hist[RAYDIUM_CONSOLE_MAX_LINES];
int i,n;
n=raydium_console_history_read(hist);
for(i=0;i<n;i++)
printf("> %s\n",hist[i]);
```

Warning: Be sure that there's no new history line between the call and the end of [hist](#) usage (Or copy [hist](#) to a safer place).

#### 34.12 void raydium\_console\_event (void):

Internal use. Will switch console up and down.

#### 34.13 void raydium\_console\_draw (void):

Internal use.

#### 34.14 int raydium\_console\_internal\_isalphanumuscore (char c):

Internal use.

### 34.15 void raydium\_console\_complete (char \*str):

Internal use.

## 35 Joysticks, pads and force feedback:

### 35.1 Introduction:

Raydium supports Joysticks, joypads, steering wheels, force feedback devices, keyboard emulation, for Linux only.

Since API could change during [Win32](#) integration, there is no particular documentation about this subject.

Interesting variables:

```
signed char raydium_joy_button[RAYDIUM_BUTTONS_MAX_BUTTONS];
signed char raydium_joy_click;
GLfloat raydium_joy_x;
GLfloat raydium_joy_y;
GLfloat raydium_joy_z;
int raydium_joy;

char raydium_joy_n_axes;
char raydium_joy_n_buttons;
GLfloat raydium_joy_axis[RAYDIUM_JOY_MAX_AXIS]; // "raw" axes data
```

Buttons are booleans, joy x,y and z are  $-1 \leq (x,y,z) \leq 1$  and 0 means "center".

### 35.2 void raydium\_joy\_key\_emul (void):

Emulate keyboard (directional pad) with joy, if any.

### 35.3 void raydium\_joy\_ff\_autocenter (int perc):

Set Force Feedback autocenter factor.

### 35.4 void raydium\_joy\_ff\_tremble\_set (GLfloat period, GLfloat force):

Send tremble effect to Force Feedback device for a determined period, at a particular force. (no units yet).

## 36 Graphic User Interfaces:

### 36.1 Introduction:

Raydium provides a support for simple GUI definitions thru a set of functions ([RayPHP](#) interface is available).

Raydium's GUI are themable, using ".gui" theme text files. A default "full" theme is provided as "theme-raydium2.gui" (and suitable ".tga" file) on the data repository.

Complete informations about theme building are readable in this file.

### 36.2 Vocabulary:

This API will allow declaration of:

- "widgets" (label, button, edit box, track bar, check box, combo box, zone)
- "windows" (containers for widgets)

"Focus" is supported for windows and widgets. The final user will not have any control on windows focus. "Tab" key is used for widget focus cycling.

Widgets and windows are identified by a name or by a unique numeric id.

### 36.3 Building:

The idea is simple: build a window (position and size), and create widgets over this window.

All widgets are created using the current sizes (x,y and font). See `suitable` function).

Buttons provides a simple callback, and all other widgets (but label) provides an unified "read" function. Window deletion is also possible.

You must set current theme before any of this operations (see below).

A void(void) callback is available if you want to draw something over the GUI, named `raydium_gui_AfterGuiDrawCallback`.

### 36.4 void raydium\_gui\_window\_init(int window):

Internal use. Will reset `window`.

### 36.5 void raydium\_gui\_init(void):

Internal use. Will init all GUI API. Called once by Raydium.

### 36.6 void raydium\_gui\_theme\_init(void):

Internal use. Will init theme.

### 36.7 int raydium\_gui\_theme\_load(char \*filename):

This function will load and set current theme (".gui" files). You must load a theme by yourself, since Raydium will never do it for you.

This function must be called before GUI building.

### 36.8 signed char raydium\_gui\_window\_isvalid(int i):

Mostly internal. Will check if `i` window is valid.

### 36.9 int raydium\_gui\_window\_find(char \*name):

Will search `name` window's numeric id.

### 36.10 void raydium\_gui\_window\_OnDelete(int window, void \*OnDelete?):

This function sets `OnDelete?` callback for `window` deletion.

This callback must follow void f(void) prototype. The call is done before window deletion.

### 36.11 void raydium\_gui\_window\_OnDelete\_name(char \*window, void \*OnDelete?):

Same as above, but using `window` name.

### 36.12 signed char raydium\_gui\_widget\_isvalid(int i, int window):

Mostly internal. Will check if `i` widget of `window` is valid.

### 36.13 int raydium\_gui\_widget\_find(char \*name, int window):

Will search `name` widget numeric id (for `window`).

### 36.14 void raydium\_gui\_widget\_next(void):

Mostly internal. Cycle focus.

### 36.15 void raydium\_gui\_widget\_draw\_internal(GLfloat \*uv, GLfloat \*xy):

Internal use. Generic drawing function.

### 36.16 void raydium\_gui\_button\_draw(int w, int window):

Internal use.

**36.17 void raydium\_gui\_track\_draw(int w, int window):**

Internal use.

**36.18 void raydium\_gui\_label\_draw(int w, int window):**

Internal use.

**36.19 void raydium\_gui\_edit\_draw(int w, int window):**

Internal use.

**36.20 void raydium\_gui\_check\_draw(int w, int window):**

Internal use.

**36.21 void raydium\_gui\_combo\_draw(int w, int window):**

Internal use.

**36.22 void raydium\_gui\_zone\_draw(int w, int window):**

Internal use.

**36.23 void raydium\_gui\_window\_draw(int window):**

Internal use.

**36.24 void raydium\_gui\_draw(void):**

Internal use. GUI drawing callback.

**36.25 int raydium\_gui\_button\_read(int window, int widget, char \*str):**

Internal use. Button read accessor (dummy).

**36.26 int raydium\_gui\_label\_read(int window, int widget, char \*str):**

Internal use. Label read accessor (dummy).

**36.27 int raydium\_gui\_track\_read(int window, int widget, char \*str):**

Internal use. Track read accessor.

**36.28 int raydium\_gui\_edit\_read(int window, int widget, char \*str):**

Internal use. Edit read accessor.

**36.29 int raydium\_gui\_check\_read(int window, int widget, char \*str):**

Internal use. Check read accessor.

**36.30 int raydium\_gui\_combo\_read(int window, int widget, char \*str):**

Internal use. Combo read accessor.

**36.31 int raydium\_gui\_zone\_read(int window, int widget, char \*str):**

Internal use. Zone read accessor.

**36.32 void raydium\_gui\_show(void):**

Will show current built GUI.

**36.33 void raydium\_gui\_hide(void):**

Will hide current built GUI. This is the default state.

**36.34 signed char raydium\_gui\_isvisible(void):**

Will return current visibility of GUI.

**36.35 void raydium\_gui\_window\_delete(int window):**

Will delete [window](#). No further access to widgets is possible.

**36.36 void raydium\_gui\_window\_delete\_name(char \*window):**

Same as above, but using `window`'s name.

**36.37 void raydium\_gui\_widget\_sizes(GLfloat sizex, GLfloat sizey, GLfloat font\_size):**

Each widget is created using 3 size: X size, Y size and font size. This function will allow you to set all sizes for a widget or a group of widget.

Unit: percents (screen)

**36.38 int raydium\_gui\_window\_create(char \*name, GLfloat px, GLfloat py, GLfloat sizex, GLfloat sizey):**

Obviously, this function will create a new window. This window will take focus and overlap any previous window.

`px` and `py` for X and Y position on the screen, and `sizex` and `sizey` for sizes, obviously.

Unit: percents (screen)

**36.39 int raydium\_gui\_internal\_object\_create(char \*name, int window, signed char type, GLfloat px, GLfloat py, GLfloat sizex, GLfloat sizey, GLfloat font\_size):**

Internal use.

Small (and ugly) tip: you can build many widgets with the same name, prefixing the name with '\*'.

**36.40 int raydium\_gui\_button\_create(char \*name, int window, GLfloat px, GLfloat py, char \*caption, void \*OnClick?):**

This function will create a new button, with `name` and with `window` for parent.

You need to provide a `caption` ("title") and a `OnClick?` callback function.

This callback must follow this prototype:

```
void btnButtonClick(raydium_gui_Object *w)
```

You can find `raydium_gui_Object` structure declaration in `raydium/gui.h`, if needed.

Unit for position (`px` and `py`): percents (window)

**36.41 int raydium\_gui\_button\_create\_simple(char \*name, int window, GLfloat px, GLfloat py, char \*caption):**

Same as above, but no `OnClick?` callback function is asked. This type of button is "readable" thru `raydium_gui_button_clicked()`.

**36.42 int raydium\_gui\_label\_create(char \*name, int window, GLfloat px, GLfloat py, char \*caption, GLfloat r, GLfloat g, GLfloat b):**

This function will create a new label, with `name` and with `window` for parent.

You need to provide a `caption` ("title") and an RGB color (0..1 interval)

Unit for position (`px` and `py`): percents (window)

**36.43 int raydium\_gui\_track\_create(char \*name, int window, GLfloat px, GLfloat py, int min, int max, int current):**

This function will create a new trackbar, with `name` and with `window` for parent.

You need to provide a `min` interger value, a `max` and `current` value.

Unit for position (`px` and `py`): percents (window)

**36.44 int raydium\_gui\_edit\_create(char \*name, int window, GLfloat px, GLfloat py, char \*default\_text):**

This function will create a new edit box, with `name` and with `window` for parent.

You may provide a default text (or an empty string), if needed. Unless all others Raydium's data, max string length is `RAYDIUM_GUI_DATASIZE` and not `RAYDIUM_MAX_NAME_LEN`, since this component may handle bigger strings. See `raydium/gui.h` for more informations.

Unit for position (`px` and `py`): percents (window)

**36.45 int raydium\_gui\_check\_create(char \*name, int window, GLfloat px, GLfloat py, char \*caption, signed char checked):**

This function will create a new check box, with `name` and with `window` for parent.

You need to provide a `caption` ("title") and a boolean state (checked or not).

Unit for position (`px` and `py`): percents (window)

**36.46 int raydium\_gui\_combo\_create(char \*name, int window, GLfloat px, GLfloat py, char \*items, int current):**

This function will create a new edit box, with `name` and with `window` for parent.

`items` is a string, using '\n' as a separator. It's allowed to create an empty item.

`current` is the default selected item in `items`. (first = 0)

Unless all others Raydium's data, max string length is `RAYDIUM_GUI_DATASIZE` and not `RAYDIUM_MAX_NAME_LEN`, since this component may handle bigger strings. See `raydium/gui.h` for more informations.

Unit for position (`px` and `py`): percents (window)

**36.47 int raydium\_gui\_zone\_create(char \*name, int window, GLfloat px, GLfloat py, GLfloat sx, GLfloat sy, int tag, void \*OnClick?):**

This function will create a "zone" with `name` and with `window` for parent. A zone will act like a button, but will highlight a rectangular area of the window.

This widget will return its `tag` when you'll read it, and will update `raydium_gui_button_clicked()` value when clicked.

Unit for position/size (`px`, `py`, `sx` and `sy`): percents (window)

**36.48 int raydium\_gui\_read(int window, int widget, char \*str):**

Use this function to get `widget`'s state (for `window`).

This function will always return this information thru two variable:

an integer (returned value) and a string (`str`).

This information is specific to `widget`'s type (checked or not for a checkbox, current choice for a combo, current string for an edit box, ...)

Please, note `str` must be allocated before function call. This is also the case for PHP scripts :

```
$str=str_pad(" ",256); // "pre-alloc"
$val=raydium_gui_read_name("main", "track", $str);
echo "value=$val, string='$str'";
```

**36.49 int raydium\_gui\_read\_name(char \*window, char \*widget, char \*str):**

Same as above, but `window` and `widget` are resolved thru names, and not numeric id.

**36.50 int raydium\_gui\_read\_widget(raydium\_gui\_Object \*w, char \*str):**

Same as `raydium_gui_read()`, but using a `raydium_gui_Object` pointer. Useful for button callbacks, for example.

**36.51 int raydium\_gui\_button\_clicked(void):**

This function will return the id of the last clicked button, or -1 if none were clicked.

The id is built like this : `window * 1000 + widget_id`

Usefull for PHP scripts, since it's not possible to create callback for buttons with [RayPHP](#).

**36.52 int raydium\_gui\_list\_id(char \*item, char \*list):**

This function will return `item`'s id in `list`. Returns -1 if not found.

Useful for combo index, for example.

**36.53 void raydium\_gui\_widget\_focus(int widget, int window):**

Sets focus on `widget` for `window`.

**36.54 void raydium\_gui\_widget\_focus\_name(char \*widget, char \*window):**

Same as above, but using widget and window names

## 37 Data registration:

### 37.1 Introduction:

Raydium supports scripting, for example using PHP in the current implementation.

All `raydium_register_*` functions are provided as a "bridge" between your applications and PHP scripts, allowing you to "export" native variables and functions to PHP scripts.

For more informations, see PHP chapters.

**37.2 int raydium\_register\_find\_name (char \*name):**

Lookups a variable by `name`. Search is not possible (yet) for registered functions.

Mostly used internally.

**37.3 signed char raydium\_register\_name\_isvalid (char \*name):**

Tests `name`, and returns his viability as a boolean.

Accepted intervals for variables and functions: [a-z], [A-Z] and '\_'

Numerics are not allowed.

**37.4 int raydium\_register\_variable (void \*addr, int type, char \*name):**

Will register a new variable. You must provide variable's address (`addr`), `type` and `name`.

Current available types are: `RAYDIUM_REGISTER_INT`, `RAYDIUM_REGISTER_FLOAT`, and `RAYDIUM_REGISTER_STR`.

**37.5 int raydium\_register\_variable\_const\_f(float val, char \*name):**

Will register a new `float` constant.

**37.6 int raydium\_register\_variable\_const\_i(int val, char \*name):**

Will register a new `int` constant.

### 37.7 void raydium\_register\_variable\_unregister\_last (void):

Variable are registered on a stack. As you may want to create "temporary" variables (usefull for building script's arguments, for example), this function allows you to unregister last registered variable. Multiple calls are possible.

### 37.8 int raydium\_register\_modifyi (char \*var, char \*args):

Deprecated.

### 37.9 void raydium\_register\_function (void \*addr, char \*name):

Will register a function. You only need to provide an address (`addr`) and a name.

### 37.10 void raydium\_register\_dump (void):

Will dump to console all registered variables and functions.

## 38 Profiling (sort of ...):

### 38.1 Introduction:

You will find here a few functions for a very simple profiling. For anything else than a quick time measure, use real profiling tools. Note: Use only one "profiler" at a time.

### 38.2 void raydium\_profile\_start(void):

Starts measure.

### 38.3 void raydium\_profile\_end(char \*tag):

Stops measure and displays result using `tag` string.

## 39 RayPHP (internals):

### 39.1 Introduction:

Raydium also use [RayPHP](#) (Raydium/PHP interface) for its own needs. For PHP part of these functions, see "rayphp/" directory. So far, [RayPHP](#) is dedicated to R3S (Raydium Server Side Scripts) access. All this is mostly usefull for internal uses, since Raydium provides `fopen` wrappers, thru `raydium_file_fopen`.

R3S is able to work with HTTP and FTP, and supports proxy using `raydium.db` configuration database. Example :

```
Generic-Proxy;http://proxy:3128/
```

The trailing / (slash) must be present.

### 39.2 int raydium\_rayphp\_repository\_file\_get (char \*path):

Will contact R3S servers for downloading `path` file.

### 39.3 int raydium\_rayphp\_repository\_file\_put (char \*path, int depends):

Will contact R3S servers for uploading `path` file. Set `depends` to true (1) if you also want to upload dependencies, false (0) otherwise.

### 39.4 int raydium\_rayphp\_repository\_file\_list(char \*filter):

Will contact R3S servers to get file list, using `filter` (shell-like syntax). Default `filter` is `*`.

**39.5 signed char raydium\_rayphp\_http\_test(void):**

Test if Internet connection is available using Raydium website.  
(0 means 'not available', 1 means 'OK')

**39.6 signed char raydium\_rayphp\_repository\_defaults(char \*def):**

Gives the default repositories for this applications

This function will create two files, `repositories.list` and `repositories.upload` in game user home directory, if these files don't already exist, and will fill the files with `def`.

This argument is an URL, or a list of URLs (use `\n` separator). See R3S doc.

**40 Text file parsing:****40.1 Introduction:**

Raydium provides a set of functions dedicated to text files parsing. These files must follow a simple syntax:

```
// strings
variable_s="string value";

// float (or integer, i.e.)
variable_f=10.5;

// float array
variable_a={1,2,10.5,};

// raw data
variable_r=[
xxxxxxxx
#  oo  #
#      #
#  oo  #
xxxxxxxx
];
```

Semi-colon are purely esthetic.

**40.2 void raydium\_parser\_trim (char \*org):**

Strip whitespace (or other characters) from the beginning and end of a string.  
So far, ' ', '\n' and ';' are deleted.

**40.3 signed char raydium\_parser\_isdata (char \*str):**

Returns true (1) if `str` contains data, false (0) otherwise (comments and blank lines).

**40.4 signed char raydium\_parser\_cut (char \*str, char \*part1, char \*part2, char separator):**

This function will cut `str` in two parts (`part1` and `part2`) on `separator`. No memory allocation will be done by this functions.

First occurrence of `separator` is used (left cut).

Return true (`i+1`) if `str` was cut, where `i` is the separator position.

**40.5 void raydium\_parser\_replace (char \*str, char what, char with):**

Will replace all occurrence of `what` with `with`.

**40.6 int raydium\_parser\_read (char \*var, char \*val\_s, GLfloat \*val\_f, int \*size, FILE \*fp):**

Reads a new data line in `fp`.

`var` will contain variable name. You'll find associated value in `val_s` if it's a string, or `val_f` if it's a float (or a float array). In this last case, `size` will return the number of elements if the array.

```
FILE *fp;
int ret;
char var[RAYDIUM_MAX_NAME_LEN];
char val_s[RAYDIUM_MAX_NAME_LEN];
GLfloat val_f[MY_ARRAY_SIZE];
int size;

fp=raydium_file_fopen("foobar.txt","rt");

while( (ret=raydium_parser_read(var,val_s,val_f,&size,fp))!=RAYDIUM_PARSER_TYPE_EOF)
{
if(!strcasecmp(var,"foobar_variable"))
{
if(ret!=RAYDIUM_PARSER_TYPE_FLOAT || size!=2)
{
raydium_log("error: foobar_variable is not float array");
continue;
}
memcpy(...);
}
...
}
```

#### 40.7 signed char raydium\_parser\_db\_get(char \*key, char \*value, char \*def):

This function will copy the value of `key` from Raydium's database to `value`. If `key` is not found, `def` is used as a default value.

If you do not want to use a default value, give `NULL` to `def`, and the function will return 0 when `key` was not found.

No memory allocation is done for you.

#### 40.8 signed char raydium\_parser\_db\_set(char \*key, char \*value):

Sets `key` in the Raydium's database to `value`.

This function will return 0 if failed.

## 41 Live textures and videos API:

### 41.1 Introduction:

Live API features two distinct parts:

1 - It provides an easy way to create and manage dynamic textures, since you just have to give a pointer to your image data, and call suitable function each time this image is changing.

2 - This API also supports video4linux (aka V4L), as an extension of the Live API. The main goal is to link a video4linux device (webcam, tv card, ...) to a texture. A callback is also available if you want to

get (and transform) data of every capture.

You'll find detailed informations for each domain below.

#### **41.2 Color conversion:**

Live API used to work with RGB and RGBA color formats. Since some V4L devices use other patterns, Live API needs conversion functions.

You've no need to do color conversion by yourself, consider all this as internal functions.

#### **41.3 void v4l\_copy\_420\_block (int yTL, int yTR, int yBL, int yBR, int u, int v, int rowPixels, unsigned char \*rgb, int bits):**

YUV420P block copy.

This code is not native.

#### **41.4 int v4l\_yuv420p2rgb (unsigned char \*rgb\_out, unsigned char \*yuv\_in, int width, int height, int bits):**

YUV420P to RGB conversion.

This code is not native.

#### **41.5 Live Video API:**

This part of the Live API is dedicated to video devices. For now, the support is limited to Linux thru V4L API. Every V4L compatible device should work with Live Video, but for any advanced setup of your video device (tuner configuration, source, FPS, ...), you must use an external tool.

By default, Live API supports up to 4 simultaneous devices.

#### **41.6 signed char raydium\_live\_video\_isvalid(int i):**

Internal use, but you can call this function if you want to verify if a live video device id is valid (in bounds, open, and ready to capture).

#### **41.7 int raydium\_live\_video\_find\_free(void):**

Internal use.

Finds a free live video device slot.

#### **41.8 int raydium\_live\_video\_open(char \*device, int sizex, int sizey):**

This is where you should start. This function opens `device` (something like `"/dev/video0"`), requesting `sizex` x `sizey` resolution.

If `device` is `RAYDIUM_LIVE_DEVICE_AUTO`, Raydium will use a default device, hardcoded or given thru commande line (`--video-device`).

Same story for sizes, with `RAYDIUM_LIVE_SIZE_AUTO`.

This function will try to detect a compatible palette (grayscale, rgb, yuv420p, with 4, 6, 8, 15, 16 and 24 bits per pixel) and capture method (`read()` or `mmap()`).

Returns -1 in case of error, device id otherwise.

#### **41.9 int raydium\_live\_video\_open\_auto(void):**

Same as above, but with full autodetection.

#### **41.10 int raydium\_live\_video\_read(raydium\_live\_Device \*dev):**

Internal V4L read function.

#### **41.11 void raydium\_internal\_live\_video\_callback(void):**

internal frame callback.

#### **41.12 Live API Core:**

the main goal of the Live API is to allow you to create your own

dynamic textures. The first method is to provide your own picture data thru a pointer, the second method is to use a Live Video device (see above) as data source.

#### **41.13 void raydium\_internal\_live\_close(void):**

Internal close function.

#### **41.14 void raydium\_live\_init(void):**

Internal init function.

#### **41.15 signed char raydium\_live\_texture\_isvalid(int i):**

Internal use, but you can call this function if you want to verify if a live texture id is valid (in bounds, open, and ready to capture).

#### **41.16 int raydium\_live\_texture\_find\_free(void):**

Internal use.

Finds a free live texture slot.

#### **41.17 int raydium\_live\_texture\_find(int original\_texture):**

Resolves `original_texture` id (native Raydium texture id) to a live texture id, if any.

#### **41.18 int raydium\_live\_texture\_create(char \*as, unsigned char \*data\_source, int tx, int ty, int bpp):**

Create a new Live Texture with `as` name. You must provide a `data_source` with RGB or RGBA format, with `tx` and `ty` size.

Possible bpp values are 24 (RGB) and 32 (RGBA).

Returns the live texture id, or -1 when it fails.

#### **41.19 int raydium\_live\_texture\_video(int device\_id, char \*as):**

This is another way to create a Live Texture, but using a Live Video device for data source. Provide texture name (`as`) and Live `device_id`.

#### **41.20 void raydium\_live\_texture\_refresh(int livetex):**

When your data source have changed, call this function to refresh new data to hardware. Obviously, this function is useless for Live Video textures since Raydium will automatically refresh data.

#### **41.21 void raydium\_live\_texture\_refresh\_name(char \*texture):**

Same as above, but using `texture` name.

#### **41.22 void raydium\_live\_texture\_refresh\_callback\_set(int livetex, void \*callback):**

You can create a "OnRefresh?" callback for any Live Texture (`livetex` is an id to this texture). This is mostly usefull for Live Video texture.

Your callback must follow this prototype :

```
int refresh_callback(unsigned char *data, int tx, int ty, int bpp)
```

You have full write access to `data`, allowing you to draw over

the provided picture (warning: for non video Live textures, `data` pointer is not owned by Raydium and may be "read only")

You must return 1 to confirm data flushing, or 0 to cancel this refresh.

#### **41.23 void raydium\_live\_texture\_refresh\_callback\_set\_name(char \*texture, void \*callback):**

Same as above, but using `texture` name.

#### **41.24 void raydium\_live\_texture\_mask(int livetex, GLfloat alpha):**

This function will draw a fullscreen mask using `livetex` Live Texture id and `alpha` opacity (0 means transparent, 1 means fully opaque, allowing any

intermediate value). Use this function at any place of your rendering function AFTER camera call and obviously before [raydium\\_rendering\\_finish](#).

#### **41.25 void raydium\_live\_texture\_mask\_name(char \*texture, GLfloat alpha):**

Same as above, but using [texture](#) name.

#### **41.26 void raydium\_live\_texture\_draw(int livetex, GLfloat alpha, GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2):**

This function is a clone of [raydium\\_osd\\_draw\(\)](#), dedicated to live textures.

This function will draw the video [livetex](#) on the screen, from (x1,y1) to (x2,y2).

#### **41.27 void raydium\_live\_texture\_draw\_name(char \*texture, GLfloat alpha, GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2):**

Same as above, but using [texture](#) name.

## **42 Integrated Physics (ODE):**

### **42.1 Introduction:**

Raydium allows you to build applications with full physics, using ODE (Open Dynamics Engine). ODE is "an open source, high performance library for simulating rigid body dynamics", and is fully integrated into Raydium, with the usual abstraction. You can build cars, ragdolls, rockets, ... with only few lines of code. Physics are linked to sound API, particles engine, network layer, ... so you've almost nothing else to do but setting up objects.

Raydium's website provides tutorials for building physics ready applications.

### **42.2 Vocabulary:**

Raydium physics use a simple vocabulary, with a few entities :

- Objects:

Objects are containers, with no direct visual appearance. An object contains elements and joints (see below). By default, all elements in an object doesn't collide each others. "Car", "Player", "Crane" are good object examples.

- Elements:

Elements are the main thing you will play with. An element is rendered using an associated 3D mesh, is configured with a geometry, density, a size, collides with others elements, ...

An element must be owned by an object.

For now, there is 3 element types (standard, static, fixing). Static elements are unmovable, they just collide with other elements, usefull for very big elements, or externally controlled elements (motion capture, network, haptic interface, ...), for example.

Raydium supports boxes and spheres.

- Joints:

Joints are dedicated to elements linking. A joint must be linked with two elements or unwanted behaviors may happen.

For now, Raydium supports 4 joint types (hinge, hinge2, universal, fixed), and you will find more informations with suitable functions documentation, below.

On a joint, you could setup limits (min and max for all axes) and a maximum force before joint breaks, if needed.

It's now possible to attach a joint to static environment using the constant [RAYDIUM\\_ODE\\_JOINT\\_FIXED](#) (do not use this value with "\_name" joint functions, since they want a string, not a integer constant).

- Motors:

A motor is linked to joints, and may powering an unlimited amount of joints. For now, 3 motor types are available: engine, angular and rocket.

Engine type works the same way as a car's engine: it will try to make "something" turning, at the desired speed. You can link a gearbox to this type (and only this one).

Angular type will try to rotate "something" to the desired angle, usefull for car's front wheels, for example.

Rocket type is very simple: give a force and an orientation. Usefull for creating copters, rockets, and for elements "pushing", for example. Special rocket is available for FPS style player controls. Warning, a rocket is linked to an element ! (not a joint)

- Explosions:

Explosions are not directly related to rigid body physics, but consider it as a high level primitive.

With Raydium, you have two different ways to create an explosion.

First, you can create a "blowing explosion", generating a spherical blow. Any element in this growing sphere will be ejected.

Use this for very consequent explosions only !

Next, you can create an instantaneous explosion, with a degressive blowing effect. A force is applied to every body found inside the blowing radius, proportional to distance from the explosion's center. Usefull for smaller explosions.

- Launchers:

Launchers are not real entities, but "only" tools. Obviously, they are allowing you to launch an element (you must provide force and orientation) from another element (relatively). More informations about launchers below.

### 42.3 Callbacks:

For advanced uses, you may want to enter into some "internal" parts of [RayODE](#). Many callbacks are available for such needs.

To cancel any callback, set its value to `NULL` (default value).

Here is a quick list:

- [raydium\\_ode\\_StepCallback](#)

This callback is fired before every ODE callback. Since physics callback frequency may change (see [raydium\\_ode\\_time\\_change](#)) during slow motion scenes, for example, this callback is quiet useful.

Callback prototype: `void f(void);`

- [raydium\\_ode\\_ObjectNearCollide](#)

When two objects are too near, before launching "expensive" collision tests, Raydium is firing this event.

Callback prototype: `signed char f(int obj1, int obj2);`

`obj1` and `obj2` are the two objects, and you must return true (1) if you want to "validate" collision, or false (0) if you don't want that two objects to collide.

- [raydium\\_ode\\_CollideCallback](#)

When two objects collides, Raydium will search all collisions between every elements. For each contact, this callback is fired. For complex objects, with a lot of elements, this callback may be fired a very large number of times during one ODE step ! Do only simple things here.

Callback prototype: `signed char f(int e1, int e2, dContact *c);`  
`e1` and `e2` are the two colliding elements, and you must return true (1) if you want to "validate" this contact, or false (0) to cancel this contact (and only this one !)

See ODE documentation, chapter 7.3.7, for more informations about `dContact` structure.

#### - `raydium_ode_ExplosionCallback`

At every explosion, of any type, this event is fired. This is the best place to play suitable sound, create particles and such things.

Callback prototype: `void f(signed char type, dReal radius, dReal force_or_propag, dReal *pos);`

You can find in callback params:

explosion `type` (see above), `radius`, force or propag (depending on explosion type) and `pos`, an array of 3 `dReal` values for explosion position.

The value you will find in `force_or_propag` is something like `RAYDIUM_ODE_NETWORK_EXPLOSION_*` (EXPL or BLOW).

#### - `raydium_ode_BeforeElementDrawCallback`

When `raydium_ode_draw_all(RAYDIUM_ODE_DRAW_NORMAL)` is called, for every element to draw, this callback is before element drawing.

Callback prototype: `signed char f(int elem);`

`elem` is the element'id. Return true (1) if you want to draw this element, or false (0) otherwise. This is also the best place to drawn team colors on cars, for example (see `raydium_rendering_rgb_force` for this use).

#### - `raydium_ode_AfterElementDrawCallback`

Same as the previous callback, but after element drawing.

Callback prototype: `void f(int elem);`

With the previous example (team colors), this is the place to restore default rendering state (see `raydium_rendering_rgb_normal`).

#### - `raydium_ode_RayCallback`

See ray related functions, below. This callback is used to filter elements during a ray launch.

## 42.4 Miscallenous:

By default, ODE is called 400 times per second, allowing very accurate physics. You may change this in `ode.h` with `RAYDIUM_ODE_PHYSICS_FREQ` and `RAYDIUM_ODE_TIMESTEP`, but most ERP and CFM values must be changed in your applications. ODE use a lot of cache mechanisms, so 400 Hz is a reasonable value.

Please note [RayODE](#) interface is using `dReal` ODE type for variables.

For now, `dReal` is an alias to `float` type. But please use `sizeof()`.

Raydium provides some other functions for advanced uses, and you can access directly to ODE API for very experienced users.

See also the ODE documentation: <http://opende.sourceforge.net/ode-latest-userguide.html>

#### **42.5 void raydium\_ode\_name\_auto (char \*prefix, char \*dest):**

This function will generate a single name, using `prefix`. The generated name is stored at `dest` address. No memory allocation is done.

Example : `raydium_ode_name_auto("prefix",str)` may generate something like `prefix_ode_0`.

#### **42.6 void raydium\_ode\_init\_object (int i):**

Will initialize (or erase) object `i`. Mostly for internal uses.

#### **42.7 void raydium\_ode\_init\_element (int i):**

Will initialize (or erase) element `i`. Mostly for internal uses.

#### **42.8 void raydium\_ode\_init\_joint (int i):**

Will initialize (or erase) joint `i`. Mostly for internal uses.

#### **42.9 void raydium\_ode\_init\_motor (int i):**

Will initialize (or erase) motor `i`. Mostly for internal uses.

#### **42.10 void raydium\_ode\_init\_explosion (int e):**

Will initialize (or erase) spherical explosion `i`. Mostly for internal uses.

#### **42.11 void raydium\_ode\_init (void):**

Will initialize all [RayODE](#) interface. Never call this function by yourself.

#### **42.12 signed char raydium\_ode\_object\_isvalid (int i):**

Will return 0 (false) if object `i` is not valid (free slot or out of bounds) or 1 (true) otherwise.

#### **42.13 signed char raydium\_ode\_element\_isvalid (int i):**

Will return 0 (false) if element `i` is not valid (free slot or out of bounds) or 1 (true) otherwise.

#### **42.14 signed char raydium\_ode\_joint\_isvalid (int i):**

Will return 0 (false) if joint `i` is not valid (free slot or out of bounds) or 1 (true) otherwise.

#### **42.15 signed char raydium\_ode\_motor\_isvalid (int i):**

Will return 0 (false) if motor `i` is not valid (free slot or out of bounds) or 1 (true) otherwise.

#### **42.16 signed char raydium\_ode\_explosion\_isvalid (int i):**

Will return 0 (false) if explosion `i` is not valid (free slot or out of bounds) or 1 (true) otherwise.

#### **42.17 void raydium\_ode\_ground\_dTriArrayCallback (dGeomID TriMesh?, dGeomID RefObject?, const int \*TriIndices?, int TriCount?):**

Internal. Unsupported.

#### **42.18 int raydium\_ode\_ground\_dTriCallback (dGeomID TriMesh?, dGeomID RefObject?, int TriangleIndex?):**

Internal. Unsupported.

#### **42.19 void raydium\_ode\_ground\_set\_name (char \*name):**

`ground` is a primitive for [RayODE](#) interface. You only have to set ground mesh `name` (.tri file). You may call this function many times, if needed, switching from one ground to another on the fly.

Warning: triangle normals are very important for ground models !

#### **42.20 int raydium\_ode\_object\_find (char \*name):**

Resolves object id from its `name`.

#### **42.21 int raydium\_ode\_element\_find (char \*name):**

Resolves element id from its `name`.

#### **42.22 int raydium\_ode\_joint\_find (char \*name):**

Resolves joint id from its `name`.

#### **42.23 int raydium\_ode\_motor\_find (char \*name):**

Resolves motor id from its `name`.

#### **42.24 int raydium\_ode\_explosion\_find (char \*name):**

Resolves explosion id from its `name`.

#### **42.25 int raydium\_ode\_object\_create (char \*name):**

Will build a new object with `name`. Returns new object id, or -1 when it fails.

#### **42.26 signed char raydium\_ode\_object\_rename (int o, char \*newname):**

Will rename object `o` with a `newname`.

#### **42.27 signed char raydium\_ode\_object\_rename\_name (char \*o, char \*newname):**

Same as above, but from object's name (`o`).

#### **42.28 signed char raydium\_ode\_object\_colliding (int o, signed char colliding):**

By default, all elements from an object are not colliding each others.

The only exception is for `GLOBAL` object.

If you want to change this behaviour for `o` object, sets `colliding`

to 1 (true). 0 (false) sets back to default behaviour (no internal collisions).

#### **42.29 signed char raydium\_ode\_object\_colliding\_name (char \*o, signed char colliding):**

Same as above, but using object's name.

#### **42.30 void raydium\_ode\_object\_linearvelocity\_set (int o, dReal \* vect):**

Sets linear velocity for all elements of object `o`. Velocity is sets thru

`vect`, a 3 x dReal array.

Use with caution, setting an arbitrary linear velocity may cause unwanted behaviours.

#### **42.31 void raydium\_ode\_object\_linearvelocity\_set\_name (char \*o, dReal \* vect):**

Same as above, but using object's name.

#### **42.32 void raydium\_ode\_object\_linearvelocity\_set\_name\_3f (char \*o, dReal vx, dReal vy, dReal vz):**

Same as above, but using 3 dReal values.

#### **42.33 void raydium\_ode\_object\_addforce (int o, dReal \* vect):**

Add force `vect` to all elements of object `o`.

Force is sets thru `vect`, a 3 x dReal array.

Prefer this method to `..._linearvelocity_set...` functions.

**42.34 void raydium\_ode\_object\_addforce\_name (char \*o, dReal \* vect):**

Same as above, but using object's name.

**42.35 void raydium\_ode\_object\_addforce\_name\_3f (char \*o, dReal vx, dReal vy, dReal vz):**

Same as above, but using 3 dReal values.

**42.36 void raydium\_ode\_element\_addforce (int e, dReal \* vect):**

Adds force `vect` to element `e`.

Force is sets thru `vect`, a 3 x dReal array.

**42.37 void raydium\_ode\_element\_addforce\_name (char \*e, dReal \* vect):**

Same as above, but using element's name.

**42.38 void raydium\_ode\_element\_addforce\_name\_3f (char \*e, dReal vx, dReal vy, dReal vz):**

Same as above, but using 3 dReal values.

**42.39 void raydium\_ode\_element\_addtorque (int e, dReal \* vect):**

Adds torque `vect` to element `e`.

Torque is sets thru `vect`, a 3 x dReal array.

**42.40 void raydium\_ode\_element\_addtorque\_name (char \*e, dReal \* vect):**

Same as above, but using element's name.

**42.41 void raydium\_ode\_element\_addtorque\_name\_3f (char \*e, dReal vx, dReal vy, dReal vz):**

Same as above, but using 3 dReal values.

**42.42 signed char raydium\_ode\_element\_material (int e, dReal erp, dReal cfm):**

When two elements collides, there's two important parameters used for contact point generation : ERP and CFM.

ERP means "Error Reduction Parameter", and its value is between 0 and 1 and

CFM means "Constraint Force Mixing".

Changing ERP and CFM values will change the way this element collides with other elements, providing a "material" notion.

Raydium provides a few default values, see `RAYDIUM_ODE_MATERIAL_*` defines in `raydium/ode.h` file (hard, medium, soft, soft2, default, ...).

For more informations, see ODE documentation, chapters 3.7 and 3.8.

**42.43 signed char raydium\_ode\_element\_material\_name (char \*name, dReal erp, dReal cfm):**

Same as above, but using element's name.

**42.44 signed char raydium\_ode\_element\_slip (int e, dReal slip):**

Slip parameter is a complement of material values (ERP and CFM, see above).

Raydium provides a few default values, see `RAYDIUM_ODE_SLIP_*` defines

in `raydium/ode.h` file (ice, player, normal, default).

**42.45 signed char raydium\_ode\_element\_slip\_name (char \*e, dReal slip):**

Same as above, but using element's name.

**42.46 signed char raydium\_ode\_element\_rotfriction (int e, dReal rotfriction):**

rotfriction stands for "Rotation Friction", "Rolling Friction", "Damping Effect", ...

With `RayODE`, by default, when a sphere element is rolling over a flat ground, it will roll forever. Applying a rotfriction factor will solve this.

A value of 0 will disable rotation friction.

Example:

```
#define ROTFRICTION    0.0005
raydium_ode_element_rotfriction(elem,ROTFRICTION);
```

#### 42.47 signed char raydium\_ode\_element\_rotfriction\_name (char \*e, dReal rotfriction):

Same as above, but using element's name.

#### 42.48 dReal \*raydium\_ode\_element\_linearvelocity\_get (int e):

Returns a pointer to element's linear velocity. Linear velocity is an array of 3 x dReal.

Example:

```
dReal *p;
p=raydium_ode_element_linearvelocity_get(elem);
raydium_log("%f %f %f",p[0],p[1],p[2]);
```

Returned data is available only for the current frame.

#### 42.49 dReal \*raydium\_ode\_element\_linearvelocity\_get\_name (char \*e):

Same as above, but using element's name.

#### 42.50 void raydium\_ode\_element\_OnBlow (int e, void \*OnBlow?):

During an instantaneous explosion, all elements inside the blow's radius may fire an OnBlow? callback (event), if set.

OnBlow? callback must follow this prototype :

```
void blow_touched(int elem, dReal force, dReal max_force)
```

elem is the element id.

force is the amount of force received from explosion.

max\_force is the amount of force at the core of the explosion.

Sets OnBlow? to NULL if you want to disable this callback.

#### 42.51 void raydium\_ode\_element\_OnBlow\_name (char \*e, void \*OnBlow?):

Same as above, but using element's name.

#### 42.52 void raydium\_ode\_element\_OnDelete (int e, void \*OnDelete?):

OnDelete? callback is fired when someone or something tries to delete an element.

This callback can cancel deletion, if needed.

OnDelete? callback must follow this prototype :

```
int element_delete(int elem)
```

elem is the element id. Return 1 (true) to confirm deletion, of 0 to cancel.

Sets OnDelete? to NULL if you want to disable this callback.

#### 42.53 void raydium\_ode\_element\_OnDelete\_name (char \*e, void \*OnDelete?):

Same as above, but using element's name.

#### 42.54 void raydium\_ode\_element\_gravity (int e, signed char enable):

By default, gravity applies to every element of the scene. If you want to disable gravity for element e, set enable to 0 (false).

You can restore gravity with enable sets to 1 (true).

**42.55 void raydium\_ode\_element\_gravity\_name (char \*e, signed char enable):**

Same as above, but using element's name.

**42.56 void raydium\_ode\_element\_ttl\_set (int e, int ttl):**

TTL means Time To Live. Setting a TTL on an element will automatically delete this element when TTL expires.

- TTL unit: `ttl` is given in ODE steps (see example, below).
- TTL deletion may be canceled by `OnDelete?` callback (see above).
- TTL may be changed on the fly, at anytime.
- a `ttl` value of -1 will disable TTL.

example:

```
raydium_ode_element_ttl_set(elem, RAYDIUM_ODE_PHYSICS_FREQ*5); // 5 seconds
```

**42.57 void raydium\_ode\_element\_ttl\_set\_name (char \*e, int ttl):**

Same as above, but using element's name.

**42.58 signed char raydium\_ode\_element\_aabb\_get (int element, dReal \* aabb):**

AABB means Axis-Aligned Bounding Box. This function will return element's bounding box on X, Y and Z axis.

`aabb` is a pointer to an array of 6 x dReal.

No memory allocation is done.

Will return 0 (false) in case of failure.

**42.59 signed char raydium\_ode\_element\_aabb\_get\_name (char \*element, dReal \* aabb):**

Same as above, but using element's name.

**42.60 int raydium\_ode\_element\_touched\_get (int e):**

Every element provide a "touched" flag. If element `e` is touching anything, this function will return 1 (true).

**42.61 int raydium\_ode\_element\_touched\_get\_name (char \*e):**

Same as above, but using element's name.

**42.62 signed char raydium\_ode\_element\_player\_set (int e, signed char isplayer):**

[RayODE](#) provides a special behaviour for FPS style players, also named "standing geoms". The idea is simple : a player element is always upright, and you can set an arbitrary rotation angle around Z axis anytime. Sets `isplayer` to 1 (true) to transform element `e` into a "player element".

**42.63 signed char raydium\_ode\_element\_player\_set\_name (char \*name, signed char isplayer):**

Same as above, but using element's name.

**42.64 signed char raydium\_ode\_element\_player\_get (int e):**

Returns if element `e` is a "player element" (1, true) or not (0, false).

See above for more informations about player elements.

**42.65 signed char raydium\_ode\_element\_player\_get\_name (char \*name):**

Same as above, but using element's name.

**42.66 signed char raydium\_ode\_element\_player\_angle (int e, dReal angle):**

Sets "standing geom" Z rotation [angle](#) (radian) for element [e](#).

See above for more informations about player elements.

**42.67 signed char raydium\_ode\_element\_player\_angle\_name (char \*e, dReal angle):**

Same as above, but using element's name.

**42.68 int raydium\_ode\_element\_ground\_texture\_get (int e):**

Unsupported. Do not use for now.

**42.69 int raydium\_ode\_element\_ground\_texture\_get\_name (char \*e):**

Unsupported. Do not use for now.

**42.70 int raydium\_ode\_element\_object\_get (int e):**

Since every element is owned by an object, this function will return the owner's object id.

**42.71 int raydium\_ode\_element\_object\_get\_name (char \*e):**

Same as above, but using element's name.

**42.72 int raydium\_ode\_object\_sphere\_add (char \*name, int group, dReal mass, dReal radius, signed char type, int tag, char \*mesh):**

This function will add an new "sphere" element to an object ([group](#)).

You must provide:

- [name](#): single name for this new element.
- [group](#): owner object id.
- [mass](#): density of this new element. Mass will depend on radius.
- [radius](#): radius of the element sphere geometry. Raydium is able to detect this value with [RAYDIUM\\_ODE\\_AUTODETECT](#). Things like [RAYDIUM\\_ODE\\_AUTODETECT\\*2](#) are ok, meaning "twice the detected radius".
- [type](#): [RAYDIUM\\_ODE\\_STANDARD](#) or [RAYDIUM\\_ODE\\_STATIC](#) (collide only, no physics).
- [tag](#): use this integer value as you want. The important thing is that this value is sent to network, and will be available on every connected peer. This tag must be greater or equal to 0. Suitable functions are available to read back this value later on an element.
- [mesh](#): 3D model used for rendering this element. Use an empty string to disable rendering (and not [NULL](#) !), and avoid [RAYDIUM\\_ODE\\_AUTODETECT](#) int this case.

**42.73 int raydium\_ode\_object\_box\_add (char \*name, int group, dReal mass, dReal tx, dReal ty, dReal tz, signed char type, int tag, char \*mesh):**

This function will add an new "box" element to an object ([group](#)).

Arguments are the same as [raydium\\_ode\\_object\\_sphere\\_add](#) (see above) but

[tx](#), [ty](#) and [tz](#), used for box sizes. As for spheres, you can use [RAYDIUM\\_ODE\\_AUTODETECT](#). Give this value only for [tx](#), this will automatically apply to [ty](#) and [tz](#).

Again, Things like [RAYDIUM\\_ODE\\_AUTODETECT\\*2](#) are ok, meaning "twice the detected size".

**42.74 signed char raydium\_ode\_element\_ray\_attach(int element, dReal length, dReal dirx, dReal diry, dReal dirz):**

This function will attach a ray to [element](#). This may be used as a sensor, "hitscan" line, intersection test, ...

Then you can get from this ray things like distance between the start of the ray (element's center) and the first "touched" element. You will also find wich element was touched, and where. The same applies for the last touched

element.

Do not try to retrieve informations until next frame.

You must provide ray's length (the ray won't detect "things" over that point), and direction vector (relative to element).

Since you can't set more than one ray per element, there's no problem with calling this function twice or more, it will simply override previous settings for length and direction.

Warning, ray are linked to GLOBAL object, so they will detect EVERY element, even if owned by the same object ! (only `element` is never reported).

For now, a ray will never generate contact point for touched object, you must consider them as "phantom" elements, only looking at the current world without modifying it. If you need this feature, ask for it ;)

If you want to filter wich elements are used to generate rays'informations, you can use `raydium_ode_RayCallback`. This callback is following the same prototype as `raydium_ode_CollideCallback` (see at the top of this chapter). Return 0 if you don't want this "contact" for ray informations, or 1 if you want normal behaviour.

#### **42.75 signed char raydium\_ode\_element\_ray\_attach\_name(char \*element, dReal length, dReal dirx, dReal diry, dReal dirz):**

Same as above, but using element's name.

#### **42.76 signed char raydium\_ode\_element\_ray\_delete(int element):**

Delete ray from `element`. No more ray "reports" will be available after this call.

#### **42.77 signed char raydium\_ode\_element\_ray\_delete\_name(char \*element):**

Same as above, but using element's name.

#### **42.78 signed char raydium\_ode\_element\_ray\_get(int element, raydium\_ode\_Ray \*result):**

This function allows you to retrieve informations about ray.

Here you are a sample of `raydium_ode_Ray` structure with interesting fields:

```
typedef struct raydium_ode_Ray
{
    signed char state; // is this ray active ?
    dReal    rel_dir[3];
    // farest contact
    dReal    max_dist;
    int      max_elem; // touched element, -1 if no element was touched
    dReal    max_pos[3];
    // nearest contact
    dReal    min_dist;
    int      min_elem; // touched element, -1 if no element was touched
    dReal    min_pos[3];
} raydium_ode_Ray;
```

Obviously, this function won't allocate any memory, you must provided a valid pointer.

**42.79 signed char raydium\_ode\_element\_ray\_get\_name(char \*element, raydium\_ode\_Ray \*result):**

Same as above, but using element's name.

**42.80 int raydium\_ode\_element\_fix (char \*name, int \*elem, int nelems, signed char keepgeoms):**

Experimental code.

The idea here is to create a bounding single element for a group of elements.

You must provide:

- `name`: the new bounding element's name.
- `elems`: an array of all elements to fix (id array).
- `nelems`: the number of elements in `elems` array.
- `keepgeoms`: set to 0.

You can only fix standard elements (no statics) and all elements must be owned by the same object.

**42.81 void raydium\_ode\_element\_unfix (int e):**

Experimental code. Unimplemented, yet.

Symmetric function, see [raydium\\_ode\\_element\\_fix](#).

**42.82 void raydium\_ode\_element\_move (int elem, dReal \* pos):**

This function will move element `elem` to `pos`.

`pos` is a dReal array of 3 values (x,y,z).

Warning: arbitrary moves may lead to unwanted behaviours.

**42.83 void raydium\_ode\_element\_move\_name (char \*name, dReal \* pos):**

Same as above, but using element's name.

**42.84 void raydium\_ode\_element\_move\_3f(int elem, dReal x,dReal y, dReal z):**

Same as [raydium\\_ode\\_element\\_move](#), but using 3 dReal values.

**42.85 void raydium\_ode\_element\_move\_name\_3f (char \*name, dReal x, dReal y, dReal z):**

Same as above, but using element's name.

**42.86 void raydium\_ode\_element\_rotate (int elem, dReal \* rot):**

This function will rotate element `elem` using `rot`.

`rot` is a dReal array of 3 values (rx,ry,rz), in radians.

Warning: arbitrary rotations may lead to unwanted behaviours.

**42.87 void raydium\_ode\_element\_rotate\_3f (int elem, dReal rx, dReal ry, dReal rz):**

Same as [raydium\\_ode\\_element\\_rotate](#), but using 3 dReal values.

**42.88 void raydium\_ode\_element\_rotate\_name (char \*name, dReal \* rot):**

Same as [raydium\\_ode\\_element\\_rotate](#), but using element's name.

**42.89 void raydium\_ode\_element\_rotateq (int elem, dReal \* rot):**

This function will rotate element `elem` using `rot` quaternion.

`rot` is a dReal array of 4 values.

Warning: arbitrary rotations may lead to unwanted behaviours.

**42.90 void raydium\_ode\_element\_rotateq\_name (char \*name, dReal \* rot):**

Same as [raydium\\_ode\\_element\\_rotateq](#), but using element's name.

**42.91 void raydium\_ode\_element\_rotate\_name\_3f (char \*name, dReal rx, dReal ry, dReal rz):**

Same as `raydium_ode_element_rotate_name`, but using 3 dReal values.

#### **42.92 void raydium\_ode\_object\_rotate(int obj, dReal \*rot):**

This function will try to rotate object `obj`.

For now, rotation is done around the last element of the object.

`rot` is a dReal array of 3 values (rx,ry,rz), in radians.

Warning: arbitrary rotations may lead to unwanted behaviours.

#### **42.93 void raydium\_ode\_object\_rotate\_name(char \*obj, dReal \*rot):**

Same as above, but using object's name.

#### **42.94 void raydium\_ode\_object\_rotate\_name\_3f(char \*obj, dReal rx, dReal ry, dReal rz):**

Same as above, but using 3 dReal values.

#### **42.95 void raydium\_ode\_object\_move (int obj, dReal \* pos):**

This function will move object `obj` to `pos`.

Obviously, every element of object will be moved.

`pos` is a dReal array of 3 values (x,y,z).

Warning: arbitrary moves may lead to unwanted behaviours.

#### **42.96 void raydium\_ode\_object\_move\_name (char \*name, dReal \* pos):**

Same as above, but using object's name.

#### **42.97 void raydium\_ode\_object\_move\_name\_3f (char \*name, dReal x, dReal y, dReal z):**

Same as above, but using 3 dReal values.

#### **42.98 void raydium\_ode\_object\_rotateq (int obj, dReal \* rot):**

This function will try to rotate object `obj` using `rot` quaternion.

For now, rotation is done around the last element of the object.

`rot` is a dReal array of 4 values.

Warning: arbitrary rotations may lead to unwanted behaviours.

#### **42.99 void raydium\_ode\_object\_rotateq\_name (char \*obj, dReal \* rot):**

Same as above, but using object's name.

#### **42.100 void raydium\_ode\_element\_rotate\_direction (int elem, signed char Force0OrVel1?):**

This function will rotate element `elem` from its force or velocity.

Sets `Force0OrVel1?` to 0 if you want to align element using its force or 1 using its linear velocity.

Warning: arbitrary rotations may lead to unwanted behaviours.

#### **42.101 void raydium\_ode\_element\_rotate\_direction\_name (char \*e, signed char Force0OrVel1?):**

Same as above, but using element's name.

#### **42.102 void raydium\_ode\_element\_data\_set (int e, void \*data):**

You may want to link some data to any element. If so, use this function and provide a pointer to your `data` for element `e`.

#### **42.103 void raydium\_ode\_element\_data\_set\_name (char \*e, void \*data):**

Same as above, but using element's name.

#### **42.104 void \*raydium\_ode\_element\_data\_get (int e):**

This function will return a pointer to your linked data, if any (see above).

#### **42.105 void \*raydium\_ode\_element\_data\_get\_name (char \*e):**

Same as above, but using element's name.

**42.106 int raydium\_ode\_element\_tag\_get (int e):**

When you create a new element, you must provide a "tag". This function allows you to get back the tag's value, even on "distant" elements.

**42.107 int raydium\_ode\_element\_tag\_get\_name (char \*e):**

Same as above, but using element's name.

**42.108 void raydium\_ode\_joint\_suspension (int j, dReal erp, dReal cfm):**

ERP means "Error Reduction Parameter", and its value is between 0 and 1 and CFM means "Constraint Force Mixing".

Changing ERP and CFM values will change joint energy absorption and restitution.

For more informations, see ODE documentation, chapters 3.7 and 3.8.

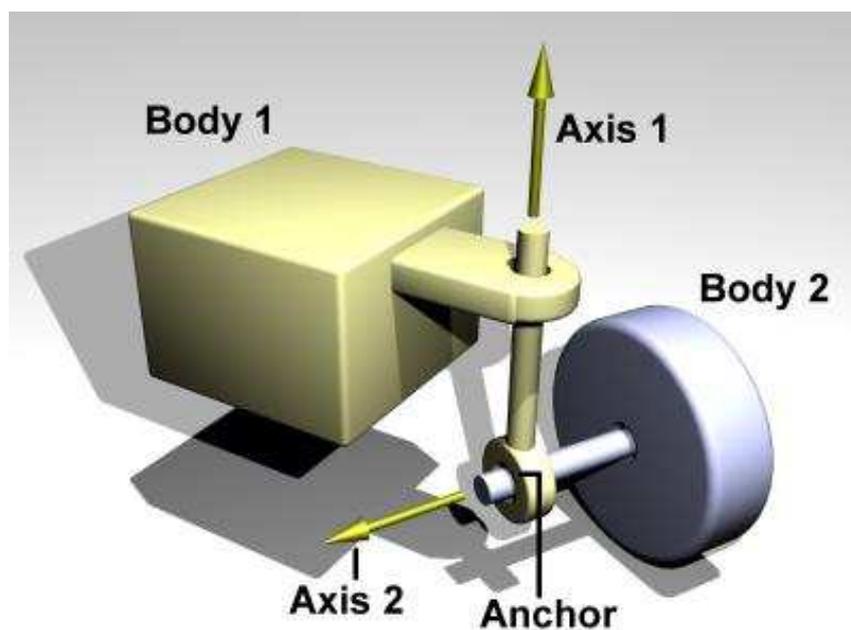
**42.109 void raydium\_ode\_joint\_suspension\_name (char \*j, dReal erp, dReal cfm):**

Same as above, but using element's name.

**42.110 int raydium\_ode\_joint\_attach\_hinge2 (char \*name, int elem1, int elem2, dReal axe1x, dReal axe1y, dReal axe1z, dReal axe2x, dReal axe2y, dReal axe2z):**

Will create a new joint between two elements ([elem1](#) and [elem2](#)).

Hinge2? is a very specialized joint, perfect for car wheel's for example.



"Axis 1 is specified relative to body 1 (this would be the steering axis if body 1 is the chassis). Axis 2 is specified relative to body 2 (this would be the wheel axis if body 2 is the wheel)."

You must also provide joint's [name](#).

Raydium provides [RAYDIUM\\_ODE\\_JOINT\\_SUSP\\_DEFAULT\\_AXES](#) define, useful for most chassis-wheel joints, and [RAYDIUM\\_ODE\\_JOINT\\_AXE\\_X](#), Y and Z for other cases.

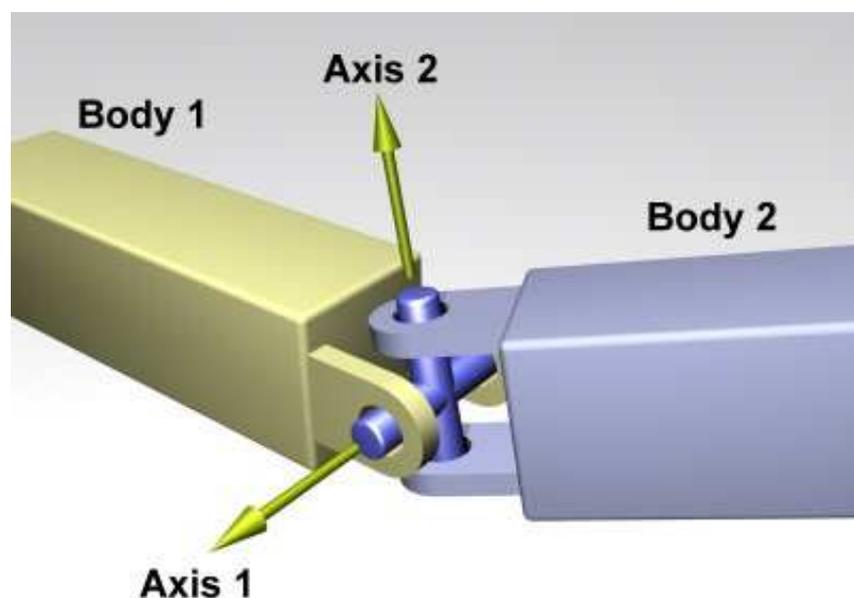
You cannot attach a static element.

**42.111 int raydium\_ode\_joint\_attach\_hinge2\_name (char \*name, char \*elem1, char \*elem2, dReal axe1x, dReal axe1y, dReal axe1z, dReal axe2x, dReal axe2y, dReal axe2z):**

Same as above, but using elements's names.

**42.112 int raydium\_ode\_joint\_attach\_universal (char \*name, int elem1, int elem2, dReal posx, dReal posy, dReal posz, dReal axe1x, dReal axe1y, dReal axe1z, dReal axe2x, dReal axe2y, dReal axe2z):**

Will create a new joint between two elements ([elem1](#) and [elem2](#)).



"Given axis 1 on body 1, and axis 2 on body 2 that is perpendicular to axis 1, it keeps them perpendicular. In other words, rotation of the two bodies about the direction perpendicular to the two axes will be equal."

"Axis 1 and axis 2 should be perpendicular to each other."

You must also provide joint's [name](#), and joint position ([posx](#), [posy](#), [posz](#)) in world coordinates.

Raydium provides [RAYDIUM\\_ODE\\_JOINT\\_AXE\\_X](#), [RAYDIUM\\_ODE\\_JOINT\\_AXE\\_Y](#) and [RAYDIUM\\_ODE\\_JOINT\\_AXE\\_Z](#) defines, that may help.

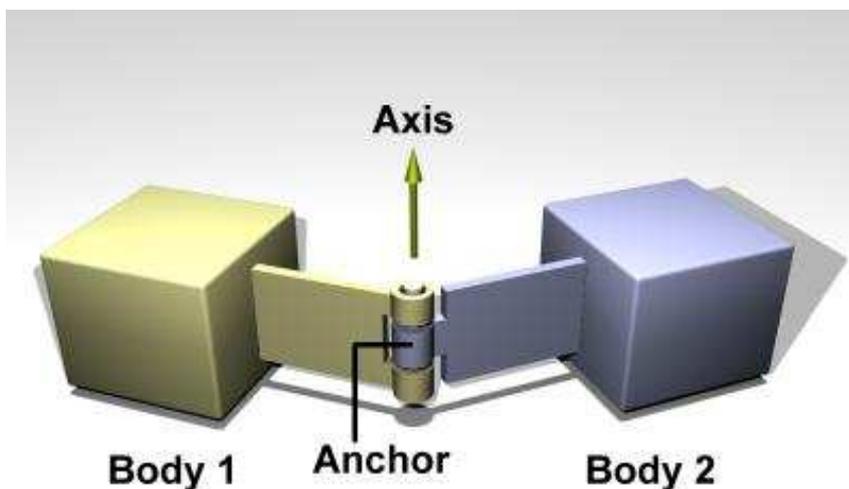
You cannot attach a static element.

**42.113 int raydium\_ode\_joint\_attach\_universal\_name (char \*name, char \*elem1, char \*elem2, dReal posx, dReal posy, dReal posz, dReal axe1x, dReal axe1y, dReal axe1z, dReal axe2x, dReal axe2y, dReal axe2z):**

Same as above, but using elements's names.

**42.114 int raydium\_ode\_joint\_attach\_hinge (char \*name, int elem1, int elem2, dReal posx, dReal posy, dReal posz, dReal axe1x, dReal axe1y, dReal axe1z):**

Will create a new joint between two elements ([elem1](#) and [elem2](#)).



You must provide joint's [name](#), and joint position ([posx](#), [posy](#), [posz](#)) in world coordinates.

Raydium provides [RAYDIUM\\_ODE\\_JOINT\\_AXE\\_X](#), [RAYDIUM\\_ODE\\_JOINT\\_AXE\\_Y](#) and [RAYDIUM\\_ODE\\_JOINT\\_AXE\\_Z](#) defines, that may help for setting axis.

You cannot attach a static element.

**42.115 int raydium\_ode\_joint\_attach\_hinge\_name (char \*name, char \*elem1, char \*elem2, dReal posx, dReal posy, dReal posz, dReal axe1x, dReal axe1y, dReal axe1z):**

Same as above, but using elements's names.

**42.116 int raydium\_ode\_joint\_attach\_fixed (char \*name, int elem1, int elem2):**

Will create a new joint between two elements ([elem1](#) and [elem2](#)).

Fixed joint is more a hack than a real joint. Use only when it's absolutely necessary, and have a look to [raydium\\_ode\\_element\\_fix](#).

You must provide joint's [name](#)

You cannot attach a static element.

**42.117 int raydium\_ode\_joint\_attach\_fixed\_name (char \*name, char \*elem1, char \*elem2):**

Same as above, but using elements's names.

**42.118 void raydium\_ode\_joint\_hinge\_limits (int j, dReal lo, dReal hi):**

Sets low ([lo](#)) and high ([hi](#)) limits for hinge joint [j](#).

**42.119 void raydium\_ode\_joint\_hinge\_limits\_name (char \*j, dReal lo, dReal hi):**

Same as above, but using joint's name.

**42.120 void raydium\_ode\_joint\_universal\_limits (int j, dReal lo1, dReal hi1, dReal lo2, dReal hi2):**

Sets low and high limits for axe 1 ([lo1](#), [hi1](#)) and axe 2 ([lo2](#), [hi2](#)) for universal joint [j](#). See [raydium\\_ode\\_joint\\_attach\\_universal](#) for more informations about universal joint axes.

**42.121 void raydium\_ode\_joint\_universal\_limits\_name (char \*j, dReal lo1, dReal hi1, dReal lo2, dReal hi2):**

Same as above, but using joint's name.

#### **42.122 void raydium\_ode\_joint\_hinge2\_block (int j, signed char block):**

Sometime, you may need to block rotation for first axe of hinge2 joints, for example with rear wheels of a car. If so, set `block` to 1 (true).

Setting `block` back to 0 (false) will restore standard rotation behaviour.

#### **42.123 void raydium\_ode\_joint\_hinge2\_block\_name (char \*name, signed char block):**

Same as above, but using joint's name.

#### **42.124 void raydium\_ode\_joint\_delete\_callback (int j, void (\*f) (int)):**

Since joints may break (see `raydium_ode_joint_break_force`), it may be useful to get a callback on joint deletion.

This callback must this prototype:

```
void joint_delete(int jid)
```

`jid` is the deleted joint id. You can't cancel joint deletion (yet).

#### **42.125 void raydium\_ode\_joint\_delete\_callback\_name (char \*name, void (\*f) (int)):**

Same as above, but using joint's name.

#### **42.126 void raydium\_ode\_joint\_break\_force (int j, dReal maxforce):**

Setting a non-zero `maxforce` on a joint will transform this joint into a "breakable joint". There's no unit for `maxforce`, you'll probably have to find the suitable value empirically.

#### **42.127 void raydium\_ode\_joint\_break\_force\_name (char \*name, dReal maxforce):**

Same as above, but using joint's name.

#### **42.128 void raydium\_ode\_joint\_elements\_get (int j, int \*e1, int \*e2):**

Will return elements (`e1` and `e2`) linked to joint `j`.

#### **42.129 void raydium\_ode\_joint\_elements\_get\_name (char \*j, int \*e1, int \*e2):**

Same as above, but using joint's name.

#### **42.130 void raydium\_ode\_motor\_update\_joints\_data\_internal (int j):**

Internal function.

#### **42.131 void raydium\_ode\_motor\_speed (int j, dReal force):**

Sets motor `j` speed parameter. This is only suitable for "engine" and "rocket" type motors. There's no special unit for `force`.

#### **42.132 void raydium\_ode\_motor\_speed\_name (char \*name, dReal force):**

Same as above, but using motor's name.

#### **42.133 void raydium\_ode\_motor\_power\_max (int j, dReal power):**

Sets motor `j` max power parameter. This is only suitable for "engine" and "angular" motors. There's no special unit for `power`.

#### **42.134 void raydium\_ode\_motor\_power\_max\_name (char \*name, dReal power):**

Same as above, but using motor's name.

#### **42.135 void raydium\_ode\_motor\_angle (int j, dReal angle):**

Sets motor `j` angle parameter. This is only suitable for "angular" motors. `angle` has the units of radians.

#### **42.136 void raydium\_ode\_motor\_angle\_name (char \*motor, dReal angle):**

Same as above, but using motor's name.

**42.137 void raydium\_ode\_motor\_gears\_set (int m, dReal \* gears, int n\_gears):**

Sets a gearbox for motor `m` (only suitable for "engine" motors).

`gears` is an array of `dReal` values, with all gears factors).

`n_gears` is the array length (total number of gears for this gearbox).

example:

```
// rear, 1, 2, 3, 4, 5
dReal gears[] = {-0.4, 0.4, 0.6, 0.8, 0.9, 1.0};
...
raydium_ode_motor_gears_set(main_engine, gears, 6);
```

If you want to cancel a gearbox, set a gearbox with only one gear with 1.0 factor value.

Raydium gearboxes implementation is very naive, with 100% output.

For example, a 0.5 gear factor will divide maximum speed by two, but will provide twice the normal torque.

**42.138 void raydium\_ode\_motor\_gears\_set\_name (char \*m, dReal \* gears, int n\_gears):**

Same as above, but using motor's name.

**42.139 void raydium\_ode\_motor\_gear\_change (int m, int gear):**

Switch motor `m` to `gear`.

**42.140 void raydium\_ode\_motor\_gear\_change\_name (char \*m, int gear):**

Same as above, but using motor's name.

**42.141 dReal \*raydium\_ode\_element\_pos\_get (int j):**

This function will return element `j`'s current position, as an array of 3 `dReal` values.

example:

```
dReal *pos;
dReal pos_copy;
...
pos = raydium_ode_element_pos_get(my_element);
raydium_log("%f %f %f", pos[0], pos[1], pos[2]);
memcpy(pos_copy, pos, sizeof(dReal)*3);
...

```

Returned data is available only for the current frame.

**42.142 dReal \*raydium\_ode\_element\_pos\_get\_name (char \*name):**

Same as above, but using element's name.

**42.143 signed char raydium\_ode\_element\_rotq\_get (int j, dReal \* res):**

This function will return element `j`'s current rotation, as an array of

4 `dReal` values (quaternion), thru `res`.

No memory allocation will be done.

**42.144 signed char raydium\_ode\_element\_rotq\_get\_name (char \*name, dReal \* res):**

Same as above, but using element's name.

**42.145 signed char raydium\_ode\_element\_rot\_get (int e, dReal \* rx, dReal \* ry, dReal \* rz):**

This code is experimental. It should returns element `e`'s current rotation using 3 `dReal` angles, in radians. Do not apply back values to the element since there're not "ODE formatted".

#### **42.146 signed char raydium\_ode\_element\_rot\_get\_name (char \*e, dReal \* rx, dReal \* ry, dReal \* rz):**

Same as above, but using element's name.

#### **42.147 void raydium\_ode\_element\_sound\_update (int e, int source):**

This function is a small bridge between [RayODE](#) and sound API, updating sound `source` using element `e`'s position.

#### **42.148 void raydium\_ode\_element\_sound\_update\_name (char \*e, int source):**

Same as above, but using element's name.

#### **42.149 void raydium\_ode\_element\_RelPointPos (int e, dReal px, dReal py, dReal pz, dReal \* res):**

Give a point (`px`, `py` and `pz`) on element `e` to this function, and it will return this point in global coordinates (`res`). Returned data is available only for the current frame.

#### **42.150 void raydium\_ode\_element\_RelPointPos\_name (char \*e, dReal px, dReal py, dReal pz, dReal \* res):**

Same as above, but using element's name.

#### **42.151 int raydium\_ode\_motor\_create (char \*name, int obj, signed char type):**

This function will create a new motor, using `name` (single), for object `obj`, with `type`. As said before, available types are `RAYDIUM_ODE_MOTOR_ENGINE`, `RAYDIUM_ODE_MOTOR_ANGULAR` and `RAYDIUM_ODE_MOTOR_ROCKET`. See the first part of this chapter for more informations about motor types.

#### **42.152 void raydium\_ode\_motor\_attach (int motor, int joint, int joint\_ave):**

This function will link `motor` to `joint`, on axe `joint_ave` (first axe is axe 0 and so on ...). This is only suitable for engine and angular motors.

#### **42.153 void raydium\_ode\_motor\_attach\_name (char \*motor, char \*joint, int joint\_ave):**

Same as above, but using motor's name and joint's name.

#### **42.154 dReal raydium\_ode\_motor\_speed\_get (int m, int gears):**

Will return current motor speed.  
For engine style motors, if `gears` is sets to 1 (true), returned speed will be relative to current motor's gear. Useless for other types.

#### **42.155 dReal raydium\_ode\_motor\_speed\_get\_name (char \*name, int gears):**

same as above, but using motor's name.

#### **42.156 void raydium\_ode\_motor\_rocket\_set (int m, int element, dReal x, dReal y, dReal z):**

This function will configure rocket motor `m` on `element` at position (`x,y,z`). Rocket motors are unusable until this function is called.

#### **42.157 void raydium\_ode\_motor\_rocket\_set\_name (char \*motor, char \*element, dReal x, dReal y, dReal z):**

same as above, but using motor's name.

#### **42.158 void raydium\_ode\_motor\_rocket\_orientation (int m, dReal rx, dReal ry, dReal rz):**

This function will rotate rocket `m` using `rx,ry` and `rz` angles in degrees. Base orientation is z up.

**42.159 void raydium\_ode\_motor\_rocket\_orientation\_name (char \*name, dReal rx, dReal ry, dReal rz):**

same as above, but using motor's name.

**42.160 void raydium\_ode\_motor\_rocket\_playermovement (int m, signed char isplayermovement):**

Will configure rocket `m` for player movements. This type of rocket will be automatically disabled when linked element is not touched by anything (ground in most cases).

**42.161 void raydium\_ode\_motor\_rocket\_playermovement\_name (char \*m, signed char isplayermovement):**

same as above, but using motor's name.

**42.162 signed char raydium\_ode\_motor\_delete (int e):**

Will obviously delete motor `e`.

**42.163 signed char raydium\_ode\_motor\_delete\_name (char \*name):**

same as above, but using motor's name.

**42.164 signed char raydium\_ode\_joint\_delete (int joint):**

Will obviously delete `joint`.

**42.165 signed char raydium\_ode\_joint\_delete\_name (char \*name):**

same as above, but using joint's name.

**42.166 signed char raydium\_ode\_element\_delete (int e, signed char deletejoints):**

Will obviously delete element `e`. Deletion may be queued for some reason, for a very short time (current collide loop). For now, you must set `deletejoints` to 1 (true), since joints without 2 linked elements are invalid.

Linked rocket engines will be deleted, too.

**42.167 signed char raydium\_ode\_element\_delete\_name (char \*name, signed char deletejoints):**

Same as above, but using element's name.

**42.168 signed char raydium\_ode\_object\_delete (int obj):**

Will obviously delete object `obj`. All elements, joints and motors will be deleted with object.

**42.169 signed char raydium\_ode\_object\_delete\_name (char \*name):**

Same as above, but using object's name.

**42.170 signed char raydium\_ode\_explosion\_delete (int e):**

Will delete `RAYDIUM_ODE_NETWORK_EXPLOSION_EXPL` type explosion `e`.

**42.171 signed char raydium\_ode\_element\_moveto (int element, int object, signed char deletejoints):**

This function will move `element` from his owner object to another `object`.

This "migration" will not be completed until `element` is not touching anymore his previous owner.

For now, you must set `deletejoints` to 1 (true), deleting linked joints.

**42.172 signed char raydium\_ode\_element\_moveto\_name (char \*element, char \*object, signed char deletejoints):**

Same as above, but using element's name and object's name.

**42.173 void raydium\_ode\_joint\_break (int j):**

Internal joint testing function.

**42.174 signed char raydium\_ode\_launcher (int element, int from\_element, dReal \* rot, dReal force):**

This function will launch an `element` from `from_element`.

You must provide `rot`, an array of 3 dReal angles in degrees, relative to `from_element` current orientation.

You must also provide a `force`, with no particular unit.

**42.175 signed char raydium\_ode\_launcher\_name (char \*element, char \*from\_element, dReal \* rot, dReal force):**

Same as above, using `element` and `from_element` names.

**42.176 signed char raydium\_ode\_launcher\_name\_3f (char \*element, char \*from\_element, dReal rx, dReal ry, dReal rz, dReal force):**

Same as above, but using 3 dReal values for rotation.

**42.177 signed char raydium\_ode\_launcher\_simple (int element, int from\_element, dReal \* lrot, dReal force):**

This function will act the same as previous ones, adding a few things:

- `element` will be aligned with `from_element` (position and rotation).
- `element` will be "migrated" to GLOBAL object during launch.

**42.178 signed char raydium\_ode\_launcher\_simple\_name (char \*element, char \*from\_element, dReal \* rot, dReal force):**

Same as above, using `element` and `from_element` names.

**42.179 signed char raydium\_ode\_launcher\_simple\_name\_3f (char \*element, char \*from\_element, dReal rx, dReal ry, dReal rz, dReal force):**

Same as above, but using 3 dReal values for rotation.

**42.180 void raydium\_ode\_explosion\_blow (dReal radius, dReal max\_force, dReal \* pos):**

This function will create an instantaneous explosion, generating a degressive blowing effect.

You must provide a `radius` (normal world units), a maximum force (`max_force`), and a position (`pos`, 3 x dReal array).

**42.181 void raydium\_ode\_explosion\_blow\_3f (dReal radius, dReal max\_force, dReal px, dReal py, dReal pz):**

Same as above, but using 3 dReal values for position.

**42.182 void raydium\_ode\_explosion\_blow\_rand(dReal radius, dReal max\_force, dReal rand\_factor, dReal \*pos):**

Same as `raydium_ode_explosion_blow_rand()`, but introducing a random factor on resulting torque for blowed objects, for a more realistic effect.

**42.183 void raydium\_ode\_explosion\_blow\_rand\_3f(dReal radius, dReal max\_force, dReal rand\_factor, dReal px, dReal py, dReal pz):**

Same as above, but using 3 dReal values for position.

**42.184 int raydium\_ode\_explosion\_create (char \*name, dReal final\_radius, dReal propag, dReal \* pos):**

This function will create an spherical growing explosion. Any element in the explosion will be ejected.

As said before: "Use this for very consequent explosions only !".

You must provide `final_radius`, `propag` (growing size) and a position (`pos`, 3 x dReal array).

When an explosion reach its final radius, it will be deleted.

**42.185 void raydium\_ode\_element\_camera\_inboard (int e, dReal px, dReal py, dReal pz, dReal lookx, dReal looky, dReal lookz):**

[RayODE](#) to camera API bridge.

Sets the camera on element `e` at relative position (`px,py,pz`),

and looking at (`lookx,looky,lookz`) relative point.

**42.186 void raydium\_ode\_element\_camera\_inboard\_name (char \*name, dReal px, dReal py, dReal pz, dReal lookx, dReal looky, dReal lookz):**

Same as above, but using element's name.

**42.187 void raydium\_ode\_draw\_all (signed char names):**

This function will draw all [RayODE](#) scene. You must call this function by yourself.

Sets `names` to `RAYDIUM_ODE_DRAW_NORMAL` for normal rendering.

Other `names` values will:

- draw only elements, joints and motors names and elements bounding boxes

with `RAYDIUM_ODE_DRAW_DEBUG`

- draw only objets AABB (Axis-Aligned Bounding Box) with `RAYDIUM_ODE_DRAW_AABB`

- draw only element rays (if any) with `RAYDIUM_ODE_DRAW_RAY`

... so you may need multiple call to this function each frame.

**42.188 void raydium\_ode\_near\_callback (void \*data, dGeomID o1, dGeomID o2):**

Internal callback.

**42.189 void raydium\_ode\_callback (void):**

Internal frame callback.

**42.190 void raydium\_ode\_time\_change (GLfloat perc):**

This function will change [RayODE](#) timecall frequency, allowing slow motion effects, for example. This function will automatically adjust particle engine time base.

`perc` is the percentage of the normal time base.

Since this function obviously do not change physics accuracy, be careful with `perc > 100`, wich will generate a big load for the CPU.

This function also change particles and mesh animations time.

**42.191 void raydium\_ode\_element\_particle (int elem, char \*filename):**

This function will "fix" a particle generator on element `elem`. You must provide particle generator's `filename`.

**42.192 void raydium\_ode\_element\_particle\_name (char \*elem, char \*filename):**

Same as above, using element's name.

**42.193 void raydium\_ode\_element\_particle\_offset (int elem, char \*filename, dReal \* offset):**

Same as `raydium_ode_element_particle`, but with an `offset`, relative to element. `offset` is an array of 3 dReal values.

**42.194 void raydium\_ode\_element\_particle\_offset\_name (char \*elem, char \*filename, dReal \*offset):**

Same as above, using element's name.

**42.195 void raydium\_ode\_element\_particle\_offset\_name\_3f (char \*elem, char \*filename, dReal ox, dReal oy, dReal oz):**

Same as above, but using 3 dReal values for offset.

**42.196 void raydium\_ode\_element\_particle\_point (int elem, char \*filename):**

Same as [raydium\\_ode\\_element\\_particle](#), but generator will not be linked with element, only positioned at current element's position.

**42.197 void raydium\_ode\_element\_particle\_point\_name (char \*elem, char \*filename):**

Same as above, using element's name.

**42.198 void raydium\_camera\_smooth\_path\_to\_element (char \*path, int element, GLfloat path\_step, GLfloat smooth\_step):**

This function is a clone of [raydium\\_camera\\_smooth\\_path\\_to\\_pos](#) dedicated to [RayODE](#), looking at [element](#) from [path](#).

You may look at suitable chapter for more informations about [path](#), [path\\_step](#) and [smooth\\_step](#).

**42.199 void raydium\_camera\_smooth\_path\_to\_element\_name (char \*path, char \*element, GLfloat path\_step, GLfloat smooth\_step):**

Same as above, using element's name.

**42.200 void raydium\_camera\_smooth\_element\_to\_path\_name (char \*element, char \*path, GLfloat path\_step, GLfloat smooth\_step):**

This function is a clone of [raydium\\_camera\\_smooth\\_pos\\_to\\_path](#) dedicated to [RayODE](#), looking at [path](#), from [element](#).

Here, you must provide element's name.

You may look at suitable chapter for more informations about [path](#), [path\\_step](#) and [smooth\\_step](#).

**42.201 void raydium\_camera\_smooth\_element\_to\_path\_offset (int element, GLfloat offset\_x, GLfloat offset\_y, GLfloat offset\_z, char \*path, GLfloat path\_step, GLfloat smooth\_step):**

This function is a clone of [raydium\\_camera\\_smooth\\_pos\\_to\\_path](#) dedicated to [RayODE](#) and providing an offset (for [element](#)), looking at [path](#), from [element](#).

You may look at suitable chapter for more informations about [path](#), [path\\_step](#) and [smooth\\_step](#).

**42.202 void raydium\_camera\_smooth\_element\_to\_path\_offset\_name (char \*element, GLfloat offset\_x, GLfloat offset\_y, GLfloat offset\_z, char \*path, GLfloat path\_step, GLfloat smooth\_step):**

Same as above, using element's name.

**42.203 int raydium\_ode\_capture\_3d(char \*filename):**

This function is provided "for fun" only. The main idea is to dump all scene to a .tri file ([filename](#)). A .sprt file will also be created, wich is a special file format with all particles found during the dump. You can reload .sprt files with [raydium\\_particle\\_state\\_restore](#).

Note from source code:

```
// This function is provided "for fun" only. Not all effects are dumped:
// Missing : shadows, forced colors, before/after callbacks,
```

```
// fixed elements, ...
// Some code is pasted from file.c (and this is BAD ! :)
```

#### 42.204 int raydium\_ode\_orphans\_check(void):

Search orphans in all objects. An orphan is a geometry that exists into ODE but is not managed by [RayODE](#).

This function will print object with orphans and return total orphan count.

### 43 [RayODE](#) network layer:

#### 43.1 Introduction:

Physics engines are extremely powerful tools, but it turns to nightmares when the application must be networked. [RayODE](#) API provides its own network layer, using Raydium lower level network API. And the great thing is that you've almost anything to do !

Just choose the best "send" function and let Raydium do the rest.

[RayODE](#) Net will use udp streams, netcall (RPC), smart timeouts, predictions, dead reckoning, and many others voodoo things. Just trust.

A few things about internals:

- NID: Network ID. Every networked element have a NID.
- Distant elements are locally created using static elements, owned by an object called "DISTANT".
- `raydium_ode_network_maxfreq` defines the paquet sending frequency. By default, this value is `RAYDIUM_ODE_NETWORK_MAXFREQ`, but you can use `--ode-rate` command line switch.
- No rotation prediction is done.
- See `config.h` if you want to disable prediction (`ODE_PREDICTION`) or to debug [RayODE](#) Net (`DEBUG_ODENET`, very verbose !).
- Explosions are also automatically managed by [RayODE](#) Net.
- Do NOT use Raydium lower level network API when using [RayODE](#) Net. Use netcalls, propags and so on.

Nothing is said here about how to create a [RayODE](#) Net server. There's only a few more things to do if you already have a standard server, but since it's unsupported for now, you must have a look to existing [RayODE](#) Net servers.

#### 43.2 int raydium\_ode\_network\_MaxElementsPerPacket (void):

This function will return how many elements may be sent with current packet size (see `common.h`).

#### 43.3 int raydium\_network\_nid\_element\_find (int nid):

Internal. Find wich element have `nid`.

#### 43.4 void raydium\_ode\_network\_newdel\_event (int type, char \*buff):

Internal. NEWDEL netcall event.

NEWDEL is fired when a new element is created or deleted somewhere in the network.

#### 43.5 void raydium\_ode\_network\_nidwho\_event (int type, char \*buff):

Internal. NIDWHO netcall event.

NIDWHO is sent when someone received some "update" informations about a nid, but didn't received previous NEWDEL informations for this nid.

The nid owner will send a reply.

Most reasons for this are:

- We are a new client and we dont know anything about the whole scene.
- The NEWDEL packet was lost ("TCP style" packets may be lost too ...)

NIDWHO answer will be used by every peer to refresh its own copy of the element informations (geometry type, mesh, size and tag).

#### **43.6 void raydium\_ode\_network\_explosion\_event (int type, char \*buff):**

Internal explosion netcall event. ([RAYDIUM\\_ODE\\_NETWORK\\_EXPLOSION\\_EXPL](#) and [RAYDIUM\\_ODE\\_NETWORK\\_EXPLOSION\\_BLOW](#)).

#### **43.7 void raydium\_ode\_network\_init (void):**

Internal. Will initialize all [RayODE](#) Net layer and register netcalls.

#### **43.8 signed char raydium\_ode\_network\_TimeToSend (void):**

Almost internal. Will return 1 (true) if it's time to send a new packet, using [raydium\\_ode\\_network\\_maxfreq](#) value.

#### **43.9 void raydium\_ode\_network\_element\_send (short nelems, int \*e):**

Will send all elements of `e` array to network. You must provide array lenght using `nelems`.

To "time to send ?" test is done, you'll probably have to do it yourself.

#### **43.10 void raydium\_ode\_network\_element\_send\_all (void):**

Will try to send all elements to network. Warning, packet size may be to small to send all elements !..

#### **43.11 void raydium\_ode\_network\_element\_send\_random (int nelems):**

Will send randomly chosen elements to network. You must provide how many elements you want with `nelems`, but [RAYDIUM\\_ODE\\_NETWORK\\_OPTIMAL](#) is available.

#### **43.12 void raydium\_ode\_network\_element\_send\_iterative (int nelems):**

Will send elements to network, iteratively chose. You must provide how many elements you want with `nelems`, but [RAYDIUM\\_ODE\\_NETWORK\\_OPTIMAL](#) is available.

#### **43.13 void raydium\_ode\_network\_nidwho (int nid):**

Internal. Will ask for informations for `nid` (see above).

NID sending frequency is now limited, since a lot of overhead was generated when new clients were joining a "big" network.

#### **43.14 void raydium\_ode\_network\_apply (raydium\_ode\_network\_Event \* ev):**

Internal. This callback is fired when new data is received. A lot of things are done here (timeouts, dead reckoning, ...)

#### **43.15 void raydium\_ode\_network\_read (void):**

Internal. Reads new packets, if any.

#### **43.16 void raydium\_ode\_network\_element\_new (int e):**

Internal. Send a new element to network.

#### **43.17 void raydium\_ode\_network\_element\_delete (int e):**

Internal. Send "delete event" to network, since we're deleting one of "our" elements.

#### **43.18 void raydium\_ode\_network\_explosion\_send (raydium\_ode\_network\_Explosion \* exp):**

Internal. Send a new explosion event.

#### **43.19 signed char raydium\_ode\_network\_element\_isdistant (int elem):**

Will return true (1) if element `elem` is "distant", or false (0) if it's one of "our" elements.

#### **43.20 signed char raydium\_ode\_network\_element\_isdistant\_name (char \*elem):**

Same as above, but using element's name.

#### **43.21 signed char raydium\_ode\_network\_element\_distantowner(int elem):**

Returns UID (peer "user" ID) for the distant element owner. See [network.c](#) documentation for more informations about UID.

#### **43.22 signed char raydium\_ode\_network\_element\_distantowner\_name(char \*elem):**

Same as above, but using element's name.

#### **43.23 void raydium\_ode\_network\_element\_trajectory\_correct (int elem):**

Internal. Applies dead reckoning values to element.

#### **43.24 void raydium\_ode\_network\_element\_next\_local(void):**

Call this function when you don't want that the next created element is sent to network ("local only" element).

## **44 RegAPI:**

### **44.1 Introduction:**

[RegAPI](#) is an internal system that exports some Raydium's API functions to scripting engine, creating bindings.

See [RayPHP](#) chapter for more informations about scripting.

### **44.2 void raydium\_register\_api(void):**

Internal. Will register Raydium API.

## **45 Video playback:**

### **45.1 Introduction:**

Raydium supports simple video playback, thru a special video codec (JPGS), useful for menus enhancements, "speaking" thumbnails, ...

This codec only supports video, use sound API if needed.

You will find an small utility, `mk_jpgs` in Raydium source tree, didacted to movie creation.

### **45.2 How to create a movie ?:**

First, compile `mk_jpgs`: example: `gcc mk_jpgs.c -o mk_jpgs` or any other standard build command.

Then, generate JPEG pictures (using a temporary directory, if possible):

`mplayer movie.avi -vo jpeg:quality=50 -vf scale=256:256`, where you may change quality factor and output size. Use "hardware friendly" sizes (64, 128,256,...) !

You can now build JPGS file:

`./mk_jpgs 25 256 256 video.jpgs` (fps, size x, size y, output file)

### **45.3 void raydium\_video\_init(void):**

Internal use.

### **45.4 signed char raydium\_video\_isvalid(int i):**

Internal use, but you can call this function if you want to verify if a

video id is valid (in bounds and open).

#### **45.5 int raydium\_video\_find\_free(void):**

Internal use.

Finds a free video slot.

#### **45.6 int raydium\_video\_find(char \*name):**

Resolves video `name`, returning video id.

Returns -1 when video is not found.

#### **45.7 void raydium\_video\_jpeg\_decompress(FILE \*fp,unsigned char \*to):**

Internal.

#### **45.8 int raydium\_video\_open(char \*filename, char \*as):**

This function will open and prepare video `filename`, and will attach this video to a "live texture" (see Live API chapter, if needed).

#### **45.9 void raydium\_video\_callback\_video(int id):**

Internal use.

#### **45.10 void raydium\_video\_callback(void):**

Internal use. Frame callback.

#### **45.11 void raydium\_video\_delete(int id):**

Will delete video `id`. Warning: this function will not delete associated Live texture, so you may open a new video with the same texture name, but video size must be the same as the previous one.

#### **45.12 void raydium\_video\_delete\_name(char \*name):**

Same as above, using video name.

#### **45.13 void raydium\_video\_loop(int id, signed char loop):**

Sets loop attribute for the video `id`. By default, video loops. Call this function with `loop=0` to disable this behavior.

#### **45.14 void raydium\_video\_loop\_name(char \*name, signed char loop):**

Same as above, using video name.

#### **45.15 signed char raydium\_video\_isplaying(int id):**

Returns 1 if video `id` is playing, 0 if this video is stopped, and -1 if function failed.

#### **45.16 signed char raydium\_video\_isplaying\_name(char \*name):**

Same as above, using video name.

## **46 HTTP Web Tools:**

## **47 Pseudo HDR:**

### **47.1 Introduction:**

#### **47.2 void raydium\_hdr\_init(void):**

Internal use.

#### **47.3 void raydium\_hdr\_enable(void):**

**47.4 void raydium\_hdr\_disable(void):**

**47.5 void raydium\_hdr\_internal\_window\_malloc(void):**

Internal use.

**47.6 void raydium\_hdr\_block(signed char blocking):**

**47.7 void raydium\_hdr\_blur(unsigned char \*in, unsigned char \*out):**

**47.8 void raydium\_hdr\_map(void):**

**47.9 void raydium\_hdr\_map\_apply(void):**

**47.10 void raydium\_hdr\_settings\_color\_local(GLfloat r, GLfloat g, GLfloat b, GLfloat a):**

**47.11 void raydium\_hdr\_settings\_color\_ambient(GLfloat r, GLfloat g, GLfloat b, GLfloat a):**

**47.12 void raydium\_hdr\_settings\_eye(float speed, float alpha\_max):**

**47.13 void raydium\_hdr\_settings(GLfloat \*color\_local, GLfloat \*color\_ambient, float eye\_speed, float alpha\_max):**

**47.14 signed char raydium\_hdr\_texture(int texture, signed char hdr); display lists !!:**

**47.15 signed char raydium\_hdr\_texture\_name(char \*texture, signed char hdr):**

Same as above, but using *texture* name.

**47.16 void raydium\_hdr\_texture\_reset(void); display lists !!:**

## **48 Atexit functions:**

### **48.1 Introduction:**

Raydium provides its own atexit function, since [Win32](#) DLL requires a bit of magic for such things. This support is mainly here for internal reasons, you can continue to use regular atexit() in your applications.

### **48.2 int raydium\_atexit(void (\*func)(void)):**

As the original atexit():

Register a function to be called at norma program termination.

Functions so registered are called in the reverse order of their registration; no arguments are passed.

Returns 0 if successful.

### **48.3 void raydium\_atexit\_call(void):**

Internal use. Will call all registered functions.

#### **48.4 void raydium\_atexit\_init(void):**

Internal use.

## **49 Shaders:**

### **49.1 Introduction:**

Raydium provides a support for [OpenGL](#) Shading Language (GLSL).

This documentation talks only about Raydium Shader API, and not about the Shading Language itself. With Raydium, shaders works by two: you must provide a vertex shader and a fragment shader each time. This is a very usual way to do.

You must know that only one shader can be active at a time.

Once a shader is loaded, Raydium API allows you to attach this shader to a texture, so you don't have to deal manually with activation/deactivation.

You can also change all "uniform" variables from shaders using `raydium_shader_var_...()` functions.

Into this set, all functions that does not contain the `_name` suffix are only able to deal with current shader !.

You can use the global variable `raydium_shader_support` to detect if current hardware supports GLSL or not (1=OK 0=no shader support).

### **49.2 void raydium\_shader\_init(void):**

Internal use. Init all shader subsystem.

### **49.3 signed char raydium\_shader\_isvalid(int shader):**

Internal use. Returns true (1) if `shader` slot is in bounds and filled.

### **49.4 int raydium\_shader\_find(char \*name):**

Returns shader's ID using its `name`.

### **49.5 void raydium\_shader\_infolog(GLhandleARB shader):**

Internal use.

Reports full driver error message when shader compilation or linking fails.

### **49.6 int raydium\_shader\_load(char \*name, char \*file\_vert, char \*file\_frag):**

Loads the vertex shader `file_vert` and the fragment shader `file_frag`.

The shader is stored with the provided `name`. This function returns the shader ID or -1 in case of failure.

### **49.7 int raydium\_shader\_variable(int shader, char \*name):**

Returns an ID for the variable "`name`" of the provided `shader`.

### **49.8 signed char raydium\_shader\_var\_i(int var\_id, int value):**

This function will change the `value` of the variable `var_id` of the current shader.

Value is an integer.

### **49.9 signed char raydium\_shader\_var\_i\_name(char \*shader, char \*variable, int value):**

Same as above, but using shader's name and variable's name. This function is able to change the `variable's value` even is the `shader` is not the current one.

**49.10 signed char raydium\_shader\_var\_f(int var\_id, float value):**

This function will change the `value` of the variable `var_id` of the current shader.  
Value is a float.

**49.11 signed char raydium\_shader\_var\_f\_name(char \*shader, char \*variable, float value):**

Same as above, but using shader's name and variable's name. This function is able to change the `variable's value` even is the `shader` is not the current one.

**49.12 signed char raydium\_shader\_var\_2f(int var\_id, float value1, float value2):**

This function will change the `value` of the variable `var_id` of the current shader.  
Value is an "array" of 2 floats (vec2).

**49.13 signed char raydium\_shader\_var\_2f\_name(char \*shader, char \*variable, float value1, float value2):**

Same as above, but using shader's name and variable's name. This function is able to change the `variable's value` even is the `shader` is not the current one.

**49.14 signed char raydium\_shader\_var\_3f(int var\_id, float value1, float value2, float value3):**

This function will change the `value` of the variable `var_id` of the current shader.  
Value is an "array" of 3 floats (vec3).

**49.15 signed char raydium\_shader\_var\_3f\_name(char \*shader, char \*variable, float value1, float value2, float value3):**

Same as above, but using shader's name and variable's name. This function is able to change the `variable's value` even is the `shader` is not the current one.

**49.16 signed char raydium\_shader\_var\_4f(int var\_id, float value1, float value2, float value3, float value4):**

This function will change the `value` of the variable `var_id` of the current shader.  
Value is an "array" of 4 floats (vec4).

**49.17 signed char raydium\_shader\_var\_4f\_name(char \*shader, char \*variable, float value1, float value2, float value3, float value4):**

Same as above, but using shader's name and variable's name. This function is able to change the `variable's value` even is the `shader` is not the current one.

**49.18 signed char raydium\_shader\_current(int shader):**

This function will change the current active shader with `shader`.  
To disable a shader and get back to regular [OpenGL](#) fixed function pipeline, set `shader` value to `-1`.

**49.19 signed char raydium\_shader\_current\_name(char \*shader):**

Same as above, but using shader's name.

**49.20 signed char raydium\_shader\_attach\_texture(int shader, int texture):**

During rendering, each time the `texture` will be used by any object, the `shader` will be activated.

**49.21 signed char raydium\_shader\_attach\_texture\_name(char \*shader, char \*texture):**

Same as above, but using shader's name and texture's name.

## 50 PHP scripting engine:

### 50.1 Introduction:

This is the internal part of the [RayPHP](#) API, where Raydium deals with Zend engine.

All this is for internal use, so no documentation is provided.

## 51 Miscelleneous:

### 51.1 License:

Raydium engine and provided applications are released under GPL version 2.

You can found the original text of this license here :

<http://www.gnu.org/licenses/gpl.txt>

### 51.2 About CQFD Corp Raydium Team:

Alphabetical order:

batcox, Blue Prawn, Cocorobix, [FlexH](#), Jimbo, manproc, Mildred, neub, RyLe?, vicente, whisky, willou, Xfennec, Yoltie.

### 51.3 Todo:

No particular order:

- rendering core rewrite
- self-running demo
- (idea from RyLe?) 'rayphp/' scripts integration into the binary (and why not, a "PACK style" support).
- more network stack optimisations (UDP reads, mainly)
- better organisation of comp.sh and ocomp.sh files (separate options and build process)

See also my todo: <http://wiki.raydium.org/wiki/XfenneC>

Please, if you start working on a feature, say it on the Wiki.

### 51.4 Links:

<http://raydium.org> (Raydium home)

<svn://raydium.org/raydium/trunk> (SVN trunk)

<http://raydium.org/svn.php> (SVN "live" changelog)

<http://memak.raydium.org> (MeMak forum: "a game using Raydium", french)

<http://www.cqfd-corp.org> (CQFD homesite)

mailto:xfennec -AT- cqfd-corp.org

### 51.5 Grets:

RyLe?: original implementation of sound.c ([OpenAL](#) core sound API)

[BatcoX](#): export of [RayODE](#) functions into [RayPHP](#) (reg\_api.c) and additional PHP wrappers (wrappers.c)

Mildred: header and Makefile generator, dynamic version of Raydium (.so and .a) for Linux.

## 52 no documentation for shadow.h:

## 53 no documentation for myglut.h:

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*caption, GLfloat r, GLfloat g, GLfloat b)  
raydium_gui_label_draw(int w, int window)  
raydium_gui_label_read(int window, int widget, char *str)  
raydium_gui_list_id(char *item, char *list)  
raydium_gui_read(int window, int widget, char *str)  
raydium_gui_read_name(char *window, char *widget, char *str)  
raydium_gui_read_widget(raydium_gui_Object *w, char *str)  
raydium_gui_show(void)  
raydium_gui_theme_init(void)  
raydium_gui_theme_load(char *filename)  
raydium_gui_track_create(char *name, int window, GLfloat px, GLfloat py, int min, int  
max, int current)  
raydium_gui_track_draw(int w, int window)  
raydium_gui_track_read(int window, int widget, char *str)  
raydium_gui_widget_draw_internal(GLfloat *uv, GLfloat *xy)  
raydium_gui_widget_find(char *name, int window)  
raydium_gui_widget_focus(int widget, int window)  
raydium_gui_widget_focus_name(char *widget, char *window)  
raydium_gui_widget_isvalid(int i, int window)  
raydium_gui_widget_next(void)  
raydium_gui_widget_sizes(GLfloat sizex, GLfloat sizey, GLfloat font_size)  
raydium_gui_window_OnDelete(int window, void *OnDelete)  
raydium_gui_window_OnDelete_name(char *window, void *OnDelete)  
raydium_gui_window_create(char *name, GLfloat px, GLfloat py, GLfloat sizex, GLfloat  
sizey)  
raydium_gui_window_delete(int window)  
raydium_gui_window_delete_name(char *window)  
raydium_gui_window_draw(int window)  
raydium_gui_window_find(char *name)  
raydium_gui_window_init(int window)  
raydium_gui_window_isvalid(int i)  
raydium_gui_zone_create(char *name, int window, GLfloat px, GLfloat py, GLfloat sx,  
GLfloat sy, int tag, void *OnClick)  
raydium_gui_zone_draw(int w, int window)  
raydium_gui_zone_read(int window, int widget, char *str)  
raydium_hdr_block(signed char blocking)  
raydium_hdr_blur(unsigned char *in, unsigned char *out)  
raydium_hdr_disable(void)  
raydium_hdr_enable(void)  
raydium_hdr_init(void)  
raydium_hdr_internal_window_malloc(void)  
raydium_hdr_map(void)  
raydium_hdr_map_apply(void)  
raydium_hdr_settings(GLfloat *color_local, GLfloat *color_ambient, float eye_speed,  
float alpha_max)  
raydium_hdr_settings_color_ambient(GLfloat r, GLfloat g, GLfloat b, GLfloat a)  
raydium_hdr_settings_color_local(GLfloat r, GLfloat g, GLfloat b, GLfloat a)  
raydium_hdr_settings_eye(float speed, float alpha_max)  
raydium_hdr_texture(int texture, signed char hdr); // display lists !!  
raydium_hdr_texture_name(char *texture, signed char hdr)  
raydium_hdr_texture_reset(void); // display lists !!  
raydium_init_args(int argc, char * *argv)  
raydium_init_args_name(int argc, char * *argv, char *app_name)
```

[raydium\\_init\\_cli\\_option\(char \\*option, char \\*value\)](#)  
[raydium\\_init\\_cli\\_option\\_default\(char \\*option, char \\*value, char \\*default\\_value\)](#)  
[raydium\\_init\\_engine \(void\)](#)  
[raydium\\_init\\_internal\\_homedir\\_find\(char \\*\)](#)  
[raydium\\_init\\_key \(void\)](#)  
[raydium\\_init\\_lights \(void\)](#)  
[raydium\\_init\\_objects \(void\)](#)  
[raydium\\_init\\_reset \(void\)](#)  
[raydium\\_internal\\_dump \(void\)](#)  
[raydium\\_internal\\_dump\\_matrix \(int n\)](#)  
[raydium\\_internal\\_live\\_close\(void\)](#)  
[raydium\\_internal\\_live\\_video\\_callback\(void\)](#)  
[raydium\\_joy\\_ff\\_autocenter \(int perc\)](#)  
[raydium\\_joy\\_ff\\_tremble\\_set \(GLfloat period, GLfloat force\)](#)  
[raydium\\_joy\\_key\\_emul \(void\)](#)  
[raydium\\_key\\_normal\\_callback \(GLuint key, int x, int y\)](#)  
[raydium\\_key\\_pressed \(GLuint key\)](#)  
[raydium\\_key\\_special\\_callback \(GLuint key, int x, int y\)](#)  
[raydium\\_key\\_special\\_up\\_callback \(GLuint key, int x, int y\)](#)  
[raydium\\_light\\_blink\\_internal\\_update \(GLuint l\)](#)  
[raydium\\_light\\_blink\\_start \(GLuint l, int fpc\)](#)  
[raydium\\_light\\_callback \(void\)](#)  
[raydium\\_light\\_disable \(void\)](#)  
[raydium\\_light\\_enable \(void\)](#)  
[raydium\\_light\\_move \(GLuint l, GLfloat \\* vect\)](#)  
[raydium\\_light\\_off \(GLuint l\)](#)  
[raydium\\_light\\_on \(GLuint l\)](#)  
[raydium\\_light\\_reset \(GLuint l\)](#)  
[raydium\\_light\\_switch \(GLuint l\)](#)  
[raydium\\_light\\_texture\(int texture, signed char enable\)](#)  
[raydium\\_light\\_texture\\_name\(char \\*name, signed char enable\)](#)  
[raydium\\_light\\_to\\_GL\\_light \(GLuint l\)](#)  
[raydium\\_light\\_update\\_all \(GLuint l\)](#)  
[raydium\\_light\\_update\\_intensity \(GLuint l\)](#)  
[raydium\\_light\\_update\\_position \(GLuint l\)](#)  
[raydium\\_light\\_update\\_position\\_all \(void\)](#)  
[raydium\\_live\\_init\(void\)](#)  
[raydium\\_live\\_texture\\_create\(char \\*as, unsigned char \\*data\\_source, int tx, int ty, int bpp\)](#)  
[raydium\\_live\\_texture\\_draw\(int livetex, GLfloat alpha,GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2\)](#)  
[raydium\\_live\\_texture\\_draw\\_name\(char \\*texture, GLfloat alpha,GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2\)](#)  
[raydium\\_live\\_texture\\_find\(int original texture\)](#)  
[raydium\\_live\\_texture\\_find\\_free\(void\)](#)  
[raydium\\_live\\_texture\\_isvalid\(int i\)](#)  
[raydium\\_live\\_texture\\_mask\(int livetex, GLfloat alpha\)](#)  
[raydium\\_live\\_texture\\_mask\\_name\(char \\*texture, GLfloat alpha\)](#)  
[raydium\\_live\\_texture\\_refresh\(int livetex\)](#)  
[raydium\\_live\\_texture\\_refresh\\_callback\\_set\(int livetex, void \\*callback\)](#)  
[raydium\\_live\\_texture\\_refresh\\_callback\\_set\\_name\(char \\*texture, void \\*callback\)](#)  
[raydium\\_live\\_texture\\_refresh\\_name\(char \\*texture\)](#)  
[raydium\\_live\\_texture\\_video\(int device\\_id, char \\*as\)](#)  
[raydium\\_live\\_video\\_find\\_free\(void\)](#)  
[raydium\\_live\\_video\\_isvalid\(int i\)](#)  
[raydium\\_live\\_video\\_open\(char \\*device, int sizex, int sizey\)](#)  
[raydium\\_live\\_video\\_open\\_auto\(void\)](#)  
[raydium\\_live\\_video\\_read\(raydium\\_live\\_Device \\*dev\)](#)  
[raydium\\_log \(char \\*format, ...\)](#)  
[raydium\\_matrix\\_adjoint\(matrix4x4 matrix\)](#)

[raydium\\_matrix\\_determinant\(matrix4x4 matrix\)](#)  
[raydium\\_matrix\\_internal\\_adjoint\(matrix4x4 matrix, int dimension\)](#)  
[raydium\\_matrix\\_internal\\_determinant\(matrix4x4 matrix, int dimension\)](#)  
[raydium\\_matrix\\_internal\\_inverse\(matrix4x4 adjoint matrix, double det, int dimension\)](#)  
[raydium\\_matrix\\_internal\\_multiply\(matrix4x4 matrix\\_one, matrix4x4 matrix\\_two, int dimension\)](#)  
[raydium\\_matrix\\_inverse\(matrix4x4 matrix\)](#)  
[raydium\\_matrix\\_multiply\(matrix4x4 matrix1, matrix4x4 matrix2\)](#)  
[raydium\\_mouse\\_button\\_pressed \(int button\)](#)  
[raydium mouse click callback \(int but, int state, int x, int y\)](#)  
[raydium mouse hide\(\) \(macro\)](#)  
[raydium mouse\\_init \(void\)](#)  
[raydium mouse isVisible\(void\)](#)  
[raydium mouse\\_move\(x,y\) \(macro\)](#)  
[raydium mouse\\_move\\_callback \(int x, int y\)](#)  
[raydium mouse\\_show\(\) \(macro\)](#)  
[raydium network broadcast \(signed char type, char \\*buff\)](#)  
[raydium network client connect to \(char \\*server\)](#)  
[raydium network client\\_disconnect\(void\)](#)  
[raydium network\\_client\\_discover\(char \\*game, int version\)](#)  
[raydium\\_network\\_close \(void\)](#)  
[raydium\\_network\\_discover\\_getserver\(int num, char \\*name, char \\*ip, char \\*info, int \\*player\\_count, int \\*player\\_max\)](#)  
[raydium\\_network\\_discover\\_numservers\(void\)](#)  
[raydium\\_network\\_init \(void\)](#)  
[raydium\\_network\\_init\\_sub\(void\)](#)  
[raydium\\_network\\_internal\\_dump \(void\)](#)  
[raydium\\_network\\_internal\\_find\\_delay\\_addr \(int player\)](#)  
[raydium\\_network\\_internal\\_server\\_delays\\_dump \(void\)](#)  
[raydium\\_network\\_internet\\_test\(void\)](#)  
[raydium\\_network\\_linux\\_find\\_broadcast\\_interfaces\(void\)](#)  
[raydium\\_network\\_netcall\\_add \(void \\*ptr, int type, signed char tcp\)](#)  
[raydium\\_network\\_netcall\\_exec \(int type, char \\*buff\)](#)  
[raydium\\_network\\_nid\\_element\\_find \(int nid\)](#)  
[raydium\\_network\\_player\\_name \(char \\*str\)](#)  
[raydium\\_network\\_propag\\_add \(int type, void \\*data, int size\)](#)  
[raydium\\_network\\_propag\\_find \(int type\)](#)  
[raydium\\_network\\_propag\\_recv \(int type, char \\*buff\)](#)  
[raydium\\_network\\_propag\\_refresh \(int type\)](#)  
[raydium\\_network\\_propag\\_refresh\\_all \(void\)](#)  
[raydium\\_network\\_propag\\_refresh\\_id \(int i\)](#)  
[raydium\\_network\\_queue\\_ack\\_recv \(int type, char \\*buff\)](#)  
[raydium\\_network\\_queue\\_ack\\_send \(unsigned short tcpid, struct sockaddr \\*to\)](#)  
[raydium\\_network\\_queue\\_check\\_time \(void\)](#)  
[raydium\\_network\\_queue\\_element\\_add \(char \\*packet, struct sockaddr \\*to\)](#)  
[raydium\\_network\\_queue\\_element\\_init \(raydium\\_network\\_Tcp \\* e\)](#)  
[raydium\\_network\\_queue\\_is\\_tcpid \(int type\)](#)  
[raydium\\_network\\_queue\\_tcpid\\_gen \(void\)](#)  
[raydium\\_network\\_queue\\_tcpid\\_known \(unsigned short tcpid, unsigned short player\)](#)  
[raydium\\_network\\_queue\\_tcpid\\_known\\_add \(int tcpid, int player\)](#)  
[raydium\\_network\\_read \(int \\*id, signed char \\*type, char \\*buff\)](#)  
[raydium\\_network\\_read\\_faked\(void\)](#)  
[raydium\\_network\\_read\\_flushed \(int \\*id, signed char \\*type, char \\*buff\)](#)  
[raydium\\_network\\_server\\_broadcast\(char \\*name, char \\*app\\_or\\_mod, int version\)](#)  
[raydium\\_network\\_server\\_broadcast\\_check\(void\)](#)  
[raydium\\_network\\_server\\_broadcast\\_info\(char \\*info\)](#)  
[raydium\\_network\\_server\\_create \(void\)](#)  
[raydium\\_network\\_set\\_socket\\_block \(int block\)](#)  
[raydium\\_network\\_socket\\_close\(int fd\)](#)  
[raydium\\_network\\_socket\\_is\\_readable\(int fd\)](#)

[raydium\\_network\\_timeout\\_check \(void\)](#)  
[raydium\\_network\\_write \(struct sockaddr \\*to, int from, signed char type, char \\*buff\)](#)  
[raydium\\_normal\\_generate\\_lastest\\_triangle \(int default\\_visu\)](#)  
[raydium\\_normal\\_regenerate\\_all \(void\)](#)  
[raydium\\_normal\\_restore\\_all \(void\)](#)  
[raydium\\_normal\\_smooth\\_all \(void\)](#)  
[raydium\\_normal\\_smooth\\_from\\_to \(GLuint from, GLuint to\)](#)  
[raydium\\_object\\_anim \(int object, int instance, int anim\)](#)  
[raydium\\_object\\_anim\\_automatic \(int object, int anim, GLfloat factor\)](#)  
[raydium\\_object\\_anim\\_automatic\\_name \(char \\*object, char \\*anim, GLfloat factor\)](#)  
[raydium\\_object\\_anim\\_default \(int object, int anim\)](#)  
[raydium\\_object\\_anim\\_find \(int object, char \\*name\)](#)  
[raydium\\_object\\_anim\\_frame \(int object, int instance, GLfloat frame\)](#)  
[raydium\\_object\\_anim\\_frame\\_name \(char \\*object, int instance, GLfloat frame\)](#)  
[raydium\\_object\\_anim\\_generate\\_internal \(int object, int instance\)](#)  
[raydium\\_object\\_anim\\_instance \(int object, int instance\)](#)  
[raydium\\_object\\_anim\\_instance\\_name \(char \\*object, int instance\)](#)  
[raydium\\_object\\_anim\\_ispunctually \(int object, int instance\)](#)  
[raydium\\_object\\_anim\\_ispunctually\\_name \(char \\*object, int instance\)](#)  
[raydium\\_object\\_anim\\_name \(char \\*object, int instance, char \\*anim\)](#)  
[raydium\\_object\\_anim\\_punctually \(int object, int anim, int instance\)](#)  
[raydium\\_object\\_anim\\_punctually\\_name \(char \\*object, char \\*anim, int instance\)](#)  
[raydium\\_object\\_callback \(void\)](#)  
[raydium\\_object\\_deform \(GLuint obj, GLfloat ampl\)](#)  
[raydium\\_object\\_deform\\_name \(char \\*name, GLfloat ampl\)](#)  
[raydium\\_object\\_draw \(GLuint o\)](#)  
[raydium\\_object\\_draw\\_name \(char \\*name\)](#)  
[raydium\\_object\\_find \(char \\*name\)](#)  
[raydium\\_object\\_find\\_axes\\_max \(GLuint obj, GLfloat \\*tx, GLfloat \\*ty, GLfloat \\*tz\)](#)  
[raydium\\_object\\_find\\_center\\_factors \(GLuint obj, GLfloat \\*tx, GLfloat \\*ty, GLfloat \\*tz\)](#)  
[raydium\\_object\\_find\\_dist\\_max \(GLuint obj\)](#)  
[raydium\\_object\\_find\\_load \(char \\*name\)](#)  
[raydium\\_object\\_find\\_minmax \(GLuint obj, GLfloat \\*min, GLfloat \\*max\)](#)  
[raydium\\_object\\_isvalid \(int obj\)](#)  
[raydium\\_object\\_load \(char \\*filename\)](#)  
[raydium\\_object\\_reset \(GLuint o\)](#)  
[raydium\\_ode\\_callback \(void\)](#)  
[raydium\\_ode\\_capture\\_3d \(char \\*filename\)](#)  
[raydium\\_ode\\_draw\\_all \(signed char names\)](#)  
[raydium\\_ode\\_element\\_OnBlow \(int e, void \\*OnBlow\)](#)  
[raydium\\_ode\\_element\\_OnBlow\\_name \(char \\*e, void \\*OnBlow\)](#)  
[raydium\\_ode\\_element\\_OnDelete \(int e, void \\*OnDelete\)](#)  
[raydium\\_ode\\_element\\_OnDelete\\_name \(char \\*e, void \\*OnDelete\)](#)  
[raydium\\_ode\\_element\\_RelPointPos \(int e, dReal px, dReal py, dReal pz, dReal \\*res\)](#)  
[raydium\\_ode\\_element\\_RelPointPos\\_name \(char \\*e, dReal px, dReal py, dReal pz, dReal \\*res\)](#)  
[raydium\\_ode\\_element\\_aabb\\_get \(int element, dReal \\*aabb\)](#)  
[raydium\\_ode\\_element\\_aabb\\_get\\_name \(char \\*element, dReal \\*aabb\)](#)  
[raydium\\_ode\\_element\\_addforce \(int e, dReal \\*vect\)](#)  
[raydium\\_ode\\_element\\_addforce\\_name \(char \\*e, dReal \\*vect\)](#)  
[raydium\\_ode\\_element\\_addforce\\_name\\_3f \(char \\*e, dReal vx, dReal vy, dReal vz\)](#)  
[raydium\\_ode\\_element\\_addtorque \(int e, dReal \\*vect\)](#)  
[raydium\\_ode\\_element\\_addtorque\\_name \(char \\*e, dReal \\*vect\)](#)  
[raydium\\_ode\\_element\\_addtorque\\_name\\_3f \(char \\*e, dReal vx, dReal vy, dReal vz\)](#)  
[raydium\\_ode\\_element\\_camera\\_inboard \(int e, dReal px, dReal py, dReal pz, dReal lookx, dReal looky, dReal lookz\)](#)  
[raydium\\_ode\\_element\\_camera\\_inboard\\_name \(char \\*name, dReal px, dReal py, dReal pz, dReal lookx, dReal looky, dReal lookz\)](#)  
[raydium\\_ode\\_element\\_data\\_get \(int e\)](#)  
[raydium\\_ode\\_element\\_data\\_get\\_name \(char \\*e\)](#)

[raydium\\_ode\\_element\\_data\\_set \(int e, void \\*data\)](#)  
[raydium\\_ode\\_element\\_data\\_set\\_name \(char \\*e, void \\*data\)](#)  
[raydium\\_ode\\_element\\_delete \(int e, signed char deletejoints\)](#)  
[raydium\\_ode\\_element\\_delete\\_name \(char \\*name, signed char deletejoints\)](#)  
[raydium\\_ode\\_element\\_find \(char \\*name\)](#)  
[raydium\\_ode\\_element\\_fix \(char \\*name, int \\*elem, int nelems, signed char keepgeoms\)](#)  
[raydium\\_ode\\_element\\_gravity \(int e, signed char enable\)](#)  
[raydium\\_ode\\_element\\_gravity\\_name \(char \\*e, signed char enable\)](#)  
[raydium\\_ode\\_element\\_ground\\_texture\\_get \(int e\)](#)  
[raydium\\_ode\\_element\\_ground\\_texture\\_get\\_name \(char \\*e\)](#)  
[raydium\\_ode\\_element\\_isvalid \(int i\)](#)  
[raydium\\_ode\\_element\\_linearvelocity\\_get \(int e\)](#)  
[raydium\\_ode\\_element\\_linearvelocity\\_get\\_name \(char \\*e\)](#)  
[raydium\\_ode\\_element\\_material \(int e, dReal erp, dReal cfm\)](#)  
[raydium\\_ode\\_element\\_material\\_name \(char \\*name, dReal erp, dReal cfm\)](#)  
[raydium\\_ode\\_element\\_move \(int elem, dReal \\* pos\)](#)  
[raydium\\_ode\\_element\\_move\\_3f\(int elem, dReal x,dReal y, dReal z\)](#)  
[raydium\\_ode\\_element\\_move\\_name \(char \\*name, dReal \\* pos\)](#)  
[raydium\\_ode\\_element\\_move\\_name\\_3f \(char \\*name, dReal x, dReal y, dReal z\)](#)  
[raydium\\_ode\\_element\\_moveto \(int element, int object, signed char deletejoints\)](#)  
[raydium\\_ode\\_element\\_moveto\\_name \(char \\*element, char \\*object, signed char deletejoints\)](#)  
[raydium\\_ode\\_element\\_object\\_get \(int e\)](#)  
[raydium\\_ode\\_element\\_object\\_get\\_name \(char \\*e\)](#)  
[raydium\\_ode\\_element\\_particle \(int elem, char \\*filename\)](#)  
[raydium\\_ode\\_element\\_particle\\_name \(char \\*elem, char \\*filename\)](#)  
[raydium\\_ode\\_element\\_particle\\_offset \(int elem, char \\*filename, dReal \\* offset\)](#)  
[raydium\\_ode\\_element\\_particle\\_offset\\_name \(char \\*elem, char \\*filename, dReal \\* offset\)](#)  
[raydium\\_ode\\_element\\_particle\\_offset\\_name\\_3f \(char \\*elem, char \\*filename, dReal ox, dReal oy, dReal oz\)](#)  
[raydium\\_ode\\_element\\_particle\\_point \(int elem, char \\*filename\)](#)  
[raydium\\_ode\\_element\\_particle\\_point\\_name \(char \\*elem, char \\*filename\)](#)  
[raydium\\_ode\\_element\\_player\\_angle \(int e, dReal angle\)](#)  
[raydium\\_ode\\_element\\_player\\_angle\\_name \(char \\*e, dReal angle\)](#)  
[raydium\\_ode\\_element\\_player\\_get \(int e\)](#)  
[raydium\\_ode\\_element\\_player\\_get\\_name \(char \\*name\)](#)  
[raydium\\_ode\\_element\\_player\\_set \(int e, signed char isplayer\)](#)  
[raydium\\_ode\\_element\\_player\\_set\\_name \(char \\*name, signed char isplayer\)](#)  
[raydium\\_ode\\_element\\_pos\\_get \(int j\)](#)  
[raydium\\_ode\\_element\\_pos\\_get\\_name \(char \\*name\)](#)  
[raydium\\_ode\\_element\\_ray\\_attach\(int element, dReal length, dReal dirx, dReal diry, dReal dirz\)](#)  
[raydium\\_ode\\_element\\_ray\\_attach\\_name\(char \\*element, dReal length, dReal dirx, dReal diry, dReal dirz\)](#)  
[raydium\\_ode\\_element\\_ray\\_delete\(int element\)](#)  
[raydium\\_ode\\_element\\_ray\\_delete\\_name\(char \\*element\)](#)  
[raydium\\_ode\\_element\\_ray\\_get\(int element, raydium\\_ode\\_Ray \\*result\)](#)  
[raydium\\_ode\\_element\\_ray\\_get\\_name\(char \\*element, raydium\\_ode\\_Ray \\*result\)](#)  
[raydium\\_ode\\_element\\_rot\\_get \(int e, dReal \\* rx, dReal \\* ry, dReal \\* rz\)](#)  
[raydium\\_ode\\_element\\_rot\\_get\\_name \(char \\*e, dReal \\* rx, dReal \\* ry, dReal \\* rz\)](#)  
[raydium\\_ode\\_element\\_rotate \(int elem, dReal \\* rot\)](#)  
[raydium\\_ode\\_element\\_rotate\\_3f \(int elem, dReal rx, dReal ry, dReal rz\)](#)  
[raydium\\_ode\\_element\\_rotate\\_direction \(int elem, signed char Force0OrVel1\)](#)  
[raydium\\_ode\\_element\\_rotate\\_direction\\_name \(char \\*e, signed char Force0OrVel1\)](#)  
[raydium\\_ode\\_element\\_rotate\\_name \(char \\*name, dReal \\* rot\)](#)  
[raydium\\_ode\\_element\\_rotate\\_name\\_3f \(char \\*name, dReal rx, dReal ry, dReal rz\)](#)  
[raydium\\_ode\\_element\\_rotateg \(int elem, dReal \\* rot\)](#)  
[raydium\\_ode\\_element\\_rotateg\\_name \(char \\*name, dReal \\* rot\)](#)  
[raydium\\_ode\\_element\\_rotfriction \(int e, dReal rotfriction\)](#)  
[raydium\\_ode\\_element\\_rotfriction\\_name \(char \\*e, dReal rotfriction\)](#)

[raydium\\_ode\\_element\\_rotq\\_get \(int j, dReal \\* res\)](#)  
[raydium\\_ode\\_element\\_rotq\\_get\\_name \(char \\*name, dReal \\* res\)](#)  
[raydium\\_ode\\_element\\_slip \(int e, dReal slip\)](#)  
[raydium\\_ode\\_element\\_slip\\_name \(char \\*e, dReal slip\)](#)  
[raydium\\_ode\\_element\\_sound\\_update \(int e, int source\)](#)  
[raydium\\_ode\\_element\\_sound\\_update\\_name \(char \\*e, int source\)](#)  
[raydium\\_ode\\_element\\_tag\\_get \(int e\)](#)  
[raydium\\_ode\\_element\\_tag\\_get\\_name \(char \\*e\)](#)  
[raydium\\_ode\\_element\\_touched\\_get \(int e\)](#)  
[raydium\\_ode\\_element\\_touched\\_get\\_name \(char \\*e\)](#)  
[raydium\\_ode\\_element\\_ttl\\_set \(int e, int ttl\)](#)  
[raydium\\_ode\\_element\\_ttl\\_set\\_name \(char \\*e, int ttl\)](#)  
[raydium\\_ode\\_element\\_unfix \(int e\)](#)  
[raydium\\_ode\\_explosion\\_blow \(dReal radius, dReal max\\_force, dReal \\* pos\)](#)  
[raydium\\_ode\\_explosion\\_blow\\_3f \(dReal radius, dReal max\\_force, dReal px, dReal py, dReal pz\)](#)  
[raydium\\_ode\\_explosion\\_blow\\_rand\(dReal radius, dReal max\\_force, dReal rand\\_factor, dReal \\*pos\)](#)  
[raydium\\_ode\\_explosion\\_blow\\_rand\\_3f\(dReal radius, dReal max\\_force, dReal rand\\_factor, dReal px, dReal py, dReal pz\)](#)  
[raydium\\_ode\\_explosion\\_create \(char \\*name, dReal final\\_radius, dReal propag, dReal \\* pos\)](#)  
[raydium\\_ode\\_explosion\\_delete \(int e\)](#)  
[raydium\\_ode\\_explosion\\_find \(char \\*name\)](#)  
[raydium\\_ode\\_explosion\\_isvalid \(int i\)](#)  
[raydium\\_ode\\_ground\\_dTriArrayCallback \(dGeomID TriMesh, dGeomID RefObject, const int \\*TriIndices, int TriCount\)](#)  
[raydium\\_ode\\_ground\\_dTriCallback \(dGeomID TriMesh, dGeomID RefObject, int TriangleIndex\)](#)  
[raydium\\_ode\\_ground\\_set\\_name \(char \\*name\)](#)  
[raydium\\_ode\\_init \(void\)](#)  
[raydium\\_ode\\_init\\_element \(int i\)](#)  
[raydium\\_ode\\_init\\_explosion \(int e\)](#)  
[raydium\\_ode\\_init\\_joint \(int i\)](#)  
[raydium\\_ode\\_init\\_motor \(int i\)](#)  
[raydium\\_ode\\_init\\_object \(int i\)](#)  
[raydium\\_ode\\_joint\\_attach\\_fixed \(char \\*name, int elem1, int elem2\)](#)  
[raydium\\_ode\\_joint\\_attach\\_fixed\\_name \(char \\*name, char \\*elem1, char \\*elem2\)](#)  
[raydium\\_ode\\_joint\\_attach\\_hinge \(char \\*name, int elem1, int elem2, dReal posx, dReal posy, dReal posz, dReal axelx, dReal axely, dReal axelz\)](#)  
[raydium\\_ode\\_joint\\_attach\\_hinge2 \(char \\*name, int elem1, int elem2, dReal axelx, dReal axely, dReal axelz, dReal axe2x, dReal axe2y, dReal axe2z\)](#)  
[raydium\\_ode\\_joint\\_attach\\_hinge2\\_name \(char \\*name, char \\*elem1, char \\*elem2, dReal axelx, dReal axely, dReal axelz, dReal axe2x, dReal axe2y, dReal axe2z\)](#)  
[raydium\\_ode\\_joint\\_attach\\_hinge\\_name \(char \\*name, char \\*elem1, char \\*elem2, dReal posx, dReal posy, dReal posz, dReal axelx, dReal axely, dReal axelz\)](#)  
[raydium\\_ode\\_joint\\_attach\\_universal \(char \\*name, int elem1, int elem2, dReal posx, dReal posy, dReal posz, dReal axelx, dReal axely, dReal axelz, dReal axe2x, dReal axe2y, dReal axe2z\)](#)  
[raydium\\_ode\\_joint\\_attach\\_universal\\_name \(char \\*name, char \\*elem1, char \\*elem2, dReal posx, dReal posy, dReal posz, dReal axelx, dReal axely, dReal axelz, dReal axe2x, dReal axe2y, dReal axe2z\)](#)  
[raydium\\_ode\\_joint\\_break \(int j\)](#)  
[raydium\\_ode\\_joint\\_break\\_force \(int j, dReal maxforce\)](#)  
[raydium\\_ode\\_joint\\_break\\_force\\_name \(char \\*name, dReal maxforce\)](#)  
[raydium\\_ode\\_joint\\_delete \(int joint\)](#)  
[raydium\\_ode\\_joint\\_delete\\_callback \(int j, void \(\\*f\) \(int\)\)](#)  
[raydium\\_ode\\_joint\\_delete\\_callback\\_name \(char \\*name, void \(\\*f\) \(int\)\)](#)  
[raydium\\_ode\\_joint\\_delete\\_name \(char \\*name\)](#)  
[raydium\\_ode\\_joint\\_elements\\_get \(int j, int \\*e1, int \\*e2\)](#)

[raydium\\_ode\\_joint\\_elements\\_get\\_name \(char \\*j, int \\*e1, int \\*e2\)](#)  
[raydium\\_ode\\_joint\\_find \(char \\*name\)](#)  
[raydium\\_ode\\_joint\\_hinge2\\_block \(int j, signed char block\)](#)  
[raydium\\_ode\\_joint\\_hinge2\\_block\\_name \(char \\*name, signed char block\)](#)  
[raydium\\_ode\\_joint\\_hinge\\_limits \(int j, dReal lo, dReal hi\)](#)  
[raydium\\_ode\\_joint\\_hinge\\_limits\\_name \(char \\*j, dReal lo, dReal hi\)](#)  
[raydium\\_ode\\_joint\\_isvalid \(int i\)](#)  
[raydium\\_ode\\_joint\\_suspension \(int j, dReal erp, dReal cfm\)](#)  
[raydium\\_ode\\_joint\\_suspension\\_name \(char \\*j, dReal erp, dReal cfm\)](#)  
[raydium\\_ode\\_joint\\_universal\\_limits \(int j, dReal lo1, dReal hi1, dReal lo2, dReal hi2\)](#)  
[raydium\\_ode\\_joint\\_universal\\_limits\\_name \(char \\*j, dReal lo1, dReal hi1, dReal lo2, dReal hi2\)](#)  
[raydium\\_ode\\_launcher \(int element, int from\\_element, dReal \\* rot, dReal force\)](#)  
[raydium\\_ode\\_launcher\\_name \(char \\*element, char \\*from\\_element, dReal \\* rot, dReal force\)](#)  
[raydium\\_ode\\_launcher\\_name\\_3f \(char \\*element, char \\*from\\_element, dReal rx, dReal ry, dReal rz, dReal force\)](#)  
[raydium\\_ode\\_launcher\\_simple \(int element, int from\\_element, dReal \\* lrot, dReal force\)](#)  
[raydium\\_ode\\_launcher\\_simple\\_name \(char \\*element, char \\*from\\_element, dReal \\* rot, dReal force\)](#)  
[raydium\\_ode\\_launcher\\_simple\\_name\\_3f \(char \\*element, char \\*from\\_element, dReal rx, dReal ry, dReal rz, dReal force\)](#)  
[raydium\\_ode\\_motor\\_angle \(int j, dReal angle\)](#)  
[raydium\\_ode\\_motor\\_angle\\_name \(char \\*motor, dReal angle\)](#)  
[raydium\\_ode\\_motor\\_attach \(int motor, int joint, int joint\\_axe\)](#)  
[raydium\\_ode\\_motor\\_attach\\_name \(char \\*motor, char \\*joint, int joint\\_axe\)](#)  
[raydium\\_ode\\_motor\\_create \(char \\*name, int obj, signed char type\)](#)  
[raydium\\_ode\\_motor\\_delete \(int e\)](#)  
[raydium\\_ode\\_motor\\_delete\\_name \(char \\*name\)](#)  
[raydium\\_ode\\_motor\\_find \(char \\*name\)](#)  
[raydium\\_ode\\_motor\\_gear\\_change \(int m, int gear\)](#)  
[raydium\\_ode\\_motor\\_gear\\_change\\_name \(char \\*m, int gear\)](#)  
[raydium\\_ode\\_motor\\_gears\\_set \(int m, dReal \\* gears, int n\\_gears\)](#)  
[raydium\\_ode\\_motor\\_gears\\_set\\_name \(char \\*m, dReal \\* gears, int n\\_gears\)](#)  
[raydium\\_ode\\_motor\\_isvalid \(int i\)](#)  
[raydium\\_ode\\_motor\\_power\\_max \(int j, dReal power\)](#)  
[raydium\\_ode\\_motor\\_power\\_max\\_name \(char \\*name, dReal power\)](#)  
[raydium\\_ode\\_motor\\_rocket\\_orientation \(int m, dReal rx, dReal ry, dReal rz\)](#)  
[raydium\\_ode\\_motor\\_rocket\\_orientation\\_name \(char \\*name, dReal rx, dReal ry, dReal rz\)](#)  
[raydium\\_ode\\_motor\\_rocket\\_playermovement \(int m, signed char isplayermovement\)](#)  
[raydium\\_ode\\_motor\\_rocket\\_playermovement\\_name \(char \\*m, signed char isplayermovement\)](#)  
[raydium\\_ode\\_motor\\_rocket\\_set \(int m, int element, dReal x, dReal y, dReal z\)](#)  
[raydium\\_ode\\_motor\\_rocket\\_set\\_name \(char \\*motor, char \\*element, dReal x, dReal y, dReal z\)](#)  
[raydium\\_ode\\_motor\\_speed \(int j, dReal force\)](#)  
[raydium\\_ode\\_motor\\_speed\\_get \(int m, int gears\)](#)  
[raydium\\_ode\\_motor\\_speed\\_get\\_name \(char \\*name, int gears\)](#)  
[raydium\\_ode\\_motor\\_speed\\_name \(char \\*name, dReal force\)](#)  
[raydium\\_ode\\_motor\\_update\\_joints\\_data\\_internal \(int j\)](#)  
[raydium\\_ode\\_name\\_auto \(char \\*prefix, char \\*dest\)](#)  
[raydium\\_ode\\_near\\_callback \(void \\*data, dGeomID o1, dGeomID o2\)](#)  
[raydium\\_ode\\_network\\_MaxElementsPerPacket \(void\)](#)  
[raydium\\_ode\\_network\\_TimeToSend \(void\)](#)  
[raydium\\_ode\\_network\\_apply \(raydium\\_ode\\_network\\_Event \\* ev\)](#)  
[raydium\\_ode\\_network\\_element\\_delete \(int e\)](#)  
[raydium\\_ode\\_network\\_element\\_distantowner \(int elem\)](#)  
[raydium\\_ode\\_network\\_element\\_distantowner\\_name \(char \\*elem\)](#)  
[raydium\\_ode\\_network\\_element\\_isdistant \(int elem\)](#)

[raydium\\_ode\\_network\\_element\\_isdistant\\_name \(char \\*elem\)](#)  
[raydium\\_ode\\_network\\_element\\_new \(int e\)](#)  
[raydium\\_ode\\_network\\_element\\_send \(short nelems, int \\*e\)](#)  
[raydium\\_ode\\_network\\_element\\_send\\_all \(void\)](#)  
[raydium\\_ode\\_network\\_element\\_send\\_iterative \(int nelems\)](#)  
[raydium\\_ode\\_network\\_element\\_send\\_random \(int nelems\)](#)  
[raydium\\_ode\\_network\\_element\\_trajectory\\_correct \(int elem\)](#)  
[raydium\\_ode\\_network\\_elment\\_next\\_local\(void\)](#)  
[raydium\\_ode\\_network\\_explosion\\_event \(int type, char \\*buff\)](#)  
[raydium\\_ode\\_network\\_explosion\\_send \(raydium\\_ode\\_network\\_Explosion \\* exp\)](#)  
[raydium\\_ode\\_network\\_init \(void\)](#)  
[raydium\\_ode\\_network\\_newdel\\_event \(int type, char \\*buff\)](#)  
[raydium\\_ode\\_network\\_nidwho \(int nid\)](#)  
[raydium\\_ode\\_network\\_nidwho\\_event \(int type, char \\*buff\)](#)  
[raydium\\_ode\\_network\\_read \(void\)](#)  
[raydium\\_ode\\_object\\_addforce \(int o, dReal \\* vect\)](#)  
[raydium\\_ode\\_object\\_addforce\\_name \(char \\*o, dReal \\* vect\)](#)  
[raydium\\_ode\\_object\\_addforce\\_name\\_3f \(char \\*o, dReal vx, dReal vy, dReal vz\)](#)  
[raydium\\_ode\\_object\\_box\\_add \(char \\*name, int group, dReal mass, dReal tx, dReal ty, dReal tz, signed char type, int tag, char \\*mesh\)](#)  
[raydium\\_ode\\_object\\_colliding \(int o, signed char colliding\)](#)  
[raydium\\_ode\\_object\\_colliding\\_name \(char \\*o, signed char colliding\)](#)  
[raydium\\_ode\\_object\\_create \(char \\*name\)](#)  
[raydium\\_ode\\_object\\_delete \(int obj\)](#)  
[raydium\\_ode\\_object\\_delete\\_name \(char \\*name\)](#)  
[raydium\\_ode\\_object\\_find \(char \\*name\)](#)  
[raydium\\_ode\\_object\\_isvalid \(int i\)](#)  
[raydium\\_ode\\_object\\_linearvelocity\\_set \(int o, dReal \\* vect\)](#)  
[raydium\\_ode\\_object\\_linearvelocity\\_set\\_name \(char \\*o, dReal \\* vect\)](#)  
[raydium\\_ode\\_object\\_linearvelocity\\_set\\_name\\_3f \(char \\*o, dReal vx, dReal vy, dReal vz\)](#)  
[raydium\\_ode\\_object\\_move \(int obj, dReal \\* pos\)](#)  
[raydium\\_ode\\_object\\_move\\_name \(char \\*name, dReal \\* pos\)](#)  
[raydium\\_ode\\_object\\_move\\_name\\_3f \(char \\*name, dReal x, dReal y, dReal z\)](#)  
[raydium\\_ode\\_object\\_rename \(int o, char \\*newname\)](#)  
[raydium\\_ode\\_object\\_rename\\_name \(char \\*o, char \\*newname\)](#)  
[raydium\\_ode\\_object\\_rotate\(int obj, dReal \\*rot\)](#)  
[raydium\\_ode\\_object\\_rotate\\_name\(char \\*obj, dReal \\*rot\)](#)  
[raydium\\_ode\\_object\\_rotate\\_name\\_3f\(char \\*obj, dReal rx, dReal ry, dReal rz\)](#)  
[raydium\\_ode\\_object\\_rotateq \(int obj, dReal \\* rot\)](#)  
[raydium\\_ode\\_object\\_rotateq\\_name \(char \\*obj, dReal \\* rot\)](#)  
[raydium\\_ode\\_object\\_sphere\\_add \(char \\*name, int group, dReal mass, dReal radius, signed char type, int tag, char \\*mesh\)](#)  
[raydium\\_ode\\_orphans\\_check\(void\)](#)  
[raydium\\_ode\\_time\\_change \(GLfloat perc\)](#)  
[raydium\\_osd\\_alpha\\_change \(GLfloat a\)](#)  
[raydium\\_osd\\_color\\_change \(GLfloat r, GLfloat g, GLfloat b\)](#)  
[raydium\\_osd\\_color\\_ega \(char hexa\)](#)  
[raydium\\_osd\\_color\\_rgba \(GLfloat r, GLfloat g, GLfloat b, GLfloat a\)](#)  
[raydium\\_osd\\_cursor\\_draw \(void\)](#)  
[raydium\\_osd\\_cursor\\_set \(char \\*texture, GLfloat xsize, GLfloat ysize\)](#)  
[raydium\\_osd\\_draw \(int tex, GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2\)](#)  
[raydium\\_osd\\_draw\\_name \(char \\*tex, GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2\)](#)  
[raydium\\_osd\\_fade\\_callback \(void\)](#)  
[raydium\\_osd\\_fade\\_from \(GLfloat \\* from4, GLfloat \\* to4, GLfloat time\\_len, void \\*OnFadeEnd\)](#)  
[raydium\\_osd\\_fade\\_init \(void\)](#)  
[raydium\\_osd\\_internal\\_vertex \(GLfloat x, GLfloat y, GLfloat top\)](#)  
[raydium\\_osd\\_logo \(char \\*texture\)](#)  
[raydium\\_osd\\_mask \(GLfloat \\* color4\)](#)  
[raydium\\_osd\\_mask\\_texture\(int texture,GLfloat alpha\)](#)

[raydium\\_osd\\_mask\\_texture\\_clip\(int texture,GLfloat alpha, GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2\)](#)  
[raydium\\_osd\\_mask\\_texture\\_clip\\_name\(char \\*texture,GLfloat alpha, GLfloat x1, GLfloat y1, GLfloat x2, GLfloat y2\)](#)  
[raydium\\_osd\\_mask\\_texture\\_name\(char \\*texture,GLfloat alpha\)](#)  
[raydium\\_osd\\_network\\_stat\\_draw \(GLfloat px, GLfloat py, GLfloat size\)](#)  
[raydium\\_osd\\_printf \(GLfloat x, GLfloat y, GLfloat size, GLfloat spacer, char \\*texture, char \\*format, ...\)](#)  
[raydium\\_osd\\_printf\\_3D \(GLfloat x, GLfloat y, GLfloat z, GLfloat size, GLfloat spacer, char \\*texture, char \\*format, ...\)](#)  
[raydium\\_osd\\_start \(void\)](#)  
[raydium\\_osd\\_stop \(void\)](#)  
[raydium\\_parser\\_cut \(char \\*str, char \\*part1, char \\*part2, char separator\)](#)  
[raydium\\_parser\\_db\\_get\(char \\*key, char \\*value, char \\*def\)](#)  
[raydium\\_parser\\_db\\_set\(char \\*key, char \\*value\)](#)  
[raydium\\_parser\\_isdata \(char \\*str\)](#)  
[raydium\\_parser\\_read \(char \\*var, char \\*val\\_s, GLfloat \\*val\\_f, int \\*size, FILE \\*fp\)](#)  
[raydium\\_parser\\_replace \(char \\*str, char what, char with\)](#)  
[raydium\\_parser\\_trim \(char \\*org\)](#)  
[raydium\\_particle\\_callback \(void\)](#)  
[raydium\\_particle\\_draw \(raydium\\_particle\\_Particle \\* p, GLfloat ux, GLfloat uy, GLfloat uz, GLfloat rx, GLfloat ry, GLfloat rz\)](#)  
[raydium\\_particle\\_draw\\_all \(void\)](#)  
[raydium\\_particle\\_find\\_free \(void\)](#)  
[raydium\\_particle\\_generator\\_delete \(int gen\)](#)  
[raydium\\_particle\\_generator\\_delete\\_name \(char \\*gen\)](#)  
[raydium\\_particle\\_generator\\_enable \(int gen, signed char enabled\)](#)  
[raydium\\_particle\\_generator\\_enable\\_name \(char \\*gen, signed char enable\)](#)  
[raydium\\_particle\\_generator\\_find \(char \\*name\)](#)  
[raydium\\_particle\\_generator\\_isvalid \(int g\)](#)  
[raydium\\_particle\\_generator\\_load \(char \\*filename, char \\*name\)](#)  
[raydium\\_particle\\_generator\\_load\\_internal \(int generator, FILE \\* fp, char \\*filename\)](#)  
[raydium\\_particle\\_generator\\_move \(int gen, GLfloat \\* pos\)](#)  
[raydium\\_particle\\_generator\\_move\\_name \(char \\*gen, GLfloat \\* pos\)](#)  
[raydium\\_particle\\_generator\\_move\\_name\\_3f \(char \\*gen, GLfloat x, GLfloat y, GLfloat z\)](#)  
[raydium\\_particle\\_generator\\_particles\\_OnDelete \(int gen, void \\*OnDelete\)](#)  
[raydium\\_particle\\_generator\\_particles\\_OnDelete\\_name \(char \\*gen, void \\*OnDelete\)](#)  
[raydium\\_particle\\_generator\\_update \(int g, GLfloat step\)](#)  
[raydium\\_particle\\_init \(void\)](#)  
[raydium\\_particle\\_name\\_auto \(char \\*prefix, char \\*dest\)](#)  
[raydium\\_particle\\_preload \(char \\*filename\)](#)  
[raydium\\_particle\\_scale\\_all\(GLfloat scale\)](#)  
[raydium\\_particle\\_state\\_dump\(char \\*filename\)](#)  
[raydium\\_particle\\_state\\_restore\(char \\*filename\)](#)  
[raydium\\_particle\\_update \(int part, GLfloat step\)](#)  
[raydium\\_profile\\_end\(char \\*tag\)](#)  
[raydium\\_profile\\_start\(void\)](#)  
[raydium\\_random\\_0\\_x \(GLfloat i\)](#)  
[raydium\\_random\\_f \(GLfloat min, GLfloat max\)](#)  
[raydium\\_random\\_i \(int min, int max\)](#)  
[raydium\\_random\\_neg\\_pos\\_1 \(void\)](#)  
[raydium\\_random\\_pos\\_1 \(void\)](#)  
[raydium\\_random\\_proba \(GLfloat proba\)](#)  
[raydium\\_random\\_randomize \(void\)](#)  
[raydium\\_rayphp\\_http\\_test\(void\)](#)  
[raydium\\_rayphp\\_repository\\_defaults\(char \\*def\)](#)  
[raydium\\_rayphp\\_repository\\_file\\_get \(char \\*path\)](#)  
[raydium\\_rayphp\\_repository\\_file\\_list\(char \\*filter\)](#)  
[raydium\\_rayphp\\_repository\\_file\\_put \(char \\*path, int depends\)](#)  
[raydium\\_register\\_api\(void\)](#)

[raydium\\_register\\_dump \(void\)](#)  
[raydium\\_register\\_find name \(char \\*name\)](#)  
[raydium\\_register\\_function \(void \\*addr, char \\*name\)](#)  
[raydium\\_register\\_modify \(char \\*var, char \\*args\)](#)  
[raydium\\_register\\_name\\_isvalid \(char \\*name\)](#)  
[raydium\\_register\\_variable \(void \\*addr, int type, char \\*name\)](#)  
[raydium\\_register\\_variable\\_const\\_f\(float val, char \\*name\)](#)  
[raydium\\_register\\_variable\\_const\\_i\(int val, char \\*name\)](#)  
[raydium\\_register\\_variable\\_unregister\\_last \(void\)](#)  
[raydium\\_render\\_lightmap\\_color\(GLfloat \\*color\)](#)  
[raydium\\_render\\_lightmap\\_color\\_4f\(GLfloat r, GLfloat g, GLfloat b, GLfloat a\)](#)  
[raydium\\_rendering \(void\)](#)  
[raydium\\_rendering\\_displaylists\\_disable\(void\)](#)  
[raydium\\_rendering\\_displaylists\\_enable\(void\)](#)  
[raydium\\_rendering\\_finish \(void\)](#)  
[raydium\\_rendering\\_from\\_to \(GLuint from, GLuint to\)](#)  
[raydium\\_rendering\\_from\\_to\\_simple\(GLuint from, GLuint to\)](#)  
[raydium\\_rendering\\_internal\\_prepare\\_texture\\_render \(GLuint tex\)](#)  
[raydium\\_rendering\\_internal\\_restore\\_render\\_state \(void\)](#)  
[raydium\\_rendering\\_normal \(void\)](#)  
[raydium\\_rendering\\_prepare\\_texture\\_unit \(GLenum tu, GLuint tex\)](#)  
[raydium\\_rendering\\_rgb\\_force \(GLfloat r, GLfloat g, GLfloat b\)](#)  
[raydium\\_rendering\\_rgb\\_normal \(void\)](#)  
[raydium\\_rendering\\_wireframe \(void\)](#)  
[raydium\\_server\\_accept\\_new \(struct sockaddr \\*from, char \\*name\)](#)  
[raydium\\_shader\\_attach\\_texture\(int shader, int texture\)](#)  
[raydium\\_shader\\_attach\\_texture\\_name\(char \\*shader, char \\*texture\)](#)  
[raydium\\_shader\\_current\(int shader\)](#)  
[raydium\\_shader\\_current\\_name\(char \\*shader\)](#)  
[raydium\\_shader\\_find\(char \\*name\)](#)  
[raydium\\_shader\\_info\\_log\(GLhandleARB shader\)](#)  
[raydium\\_shader\\_init\(void\)](#)  
[raydium\\_shader\\_isvalid\(int shader\)](#)  
[raydium\\_shader\\_load\(char \\*name, char \\*file\\_vert, char \\*file\\_frag\)](#)  
[raydium\\_shader\\_var\\_2f\(int var\\_id, float value1, float value2\)](#)  
[raydium\\_shader\\_var\\_2f\\_name\(char \\*shader, char \\*variable, float value1, float value2\)](#)  
[raydium\\_shader\\_var\\_3f\(int var\\_id, float value1, float value2, float value3\)](#)  
[raydium\\_shader\\_var\\_3f\\_name\(char \\*shader, char \\*variable, float value1, float value2, float value3\)](#)  
[raydium\\_shader\\_var\\_4f\(int var\\_id, float value1, float value2, float value3, float value4\)](#)  
[raydium\\_shader\\_var\\_4f\\_name\(char \\*shader, char \\*variable, float value1, float value2, float value3, float value4\)](#)  
[raydium\\_shader\\_var\\_f\(int var\\_id, float value\)](#)  
[raydium\\_shader\\_var\\_f\\_name\(char \\*shader, char \\*variable, float value\)](#)  
[raydium\\_shader\\_var\\_i\(int var\\_id, int value\)](#)  
[raydium\\_shader\\_var\\_i\\_name\(char \\*shader, char \\*variable, int value\)](#)  
[raydium\\_shader\\_variable\(int shader, char \\*name\)](#)  
[raydium\\_sky\\_atmosphere\\_check\(void\)](#)  
[raydium\\_sky\\_atmosphere\\_disable\(void\)](#)  
[raydium\\_sky\\_atmosphere\\_enable\(void\)](#)  
[raydium\\_sky\\_atmosphere\\_render\(GLfloat x, GLfloat y, GLfloat z, int detail\)](#)  
[raydium\\_sky\\_box\\_cache \(void\)](#)  
[raydium\\_sky\\_box\\_render \(GLfloat x, GLfloat y, GLfloat z\)](#)  
[raydium\\_sky\\_sphere\\_render\(GLfloat x, GLfloat y, GLfloat z, int detail\)](#)  
[raydium\\_sound\\_Array3IsValid\(ALfloat \\*a\)](#)  
[raydium\\_sound\\_GetListenerOr \(ALfloat \\* Or\[\]\)](#)  
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[raydium\\_sound\\_GetListenerVel \(ALfloat \\* Vel\[\]\)](#)  
[raydium\\_sound\\_GetSourceDir \(int src, ALfloat \\* Dir\[\]\)](#)

[raydium\\_sound\\_GetSourceGain \(int src, ALfloat \\* g\)](#)  
[raydium\\_sound\\_GetSourcePitch \(int src, ALfloat \\* p\)](#)  
[raydium\\_sound\\_GetSourcePos \(int src, ALfloat \\* Pos\[\]\)](#)  
[raydium\\_sound\\_GetSourceVel \(int src, ALfloat \\* Vel\[\]\)](#)  
[raydium\\_sound\\_InitSource \(int src\)](#)  
[raydium\\_sound\\_IsPlaying\(int src\)](#)  
[raydium\\_sound\\_LoadWav \(const char \\*fname\)](#)  
[raydium\\_sound\\_SetListenerOr \(ALfloat Or\[\]\)](#)  
[raydium\\_sound\\_SetListenerPos \(ALfloat Pos\[\]\)](#)  
[raydium\\_sound\\_SetListenerVel \(ALfloat Vel\[\]\)](#)  
[raydium\\_sound\\_SetSourceDir \(int src, ALfloat Dir\[\]\)](#)  
[raydium\\_sound\\_SetSourceGain \(int src, ALfloat g\)](#)  
[raydium\\_sound\\_SetSourceLoop \(int src, signed char loop\)](#)  
[raydium\\_sound\\_SetSourcePitch \(int src, ALfloat p\)](#)  
[raydium\\_sound\\_SetSourcePos \(int src, ALfloat Pos\[\]\)](#)  
[raydium\\_sound\\_SetSourcePosCamera\(int src\)](#)  
[raydium\\_sound\\_SetSourceVel \(int src, ALfloat Vel\[\]\)](#)  
[raydium\\_sound\\_SourcePause \(int src\)](#)  
[raydium\\_sound\\_SourcePlay \(int src\)](#)  
[raydium\\_sound\\_SourceStop \(int src\)](#)  
[raydium\\_sound\\_SourceUnpause \(int src\)](#)  
[raydium\\_sound\\_SourceVerify \(int src\)](#)  
[raydium\\_sound\\_callback \(void\)](#)  
[raydium\\_sound\\_close \(void\)](#)  
[raydium\\_sound\\_init \(void\)](#)  
[raydium\\_sound\\_load\\_music \(char \\*fname\)](#)  
[raydium\\_sound\\_music\\_callback \(void\)](#)  
[raydium\\_sound\\_music\\_info\\_init\(void\)](#)  
[raydium\\_sound\\_music\\_info\\_refresh\(void\)](#)  
[raydium\\_sound\\_source\\_fade\(int src, ALfloat len\)](#)  
[raydium\\_sound\\_source\\_fade\\_to\(int src, ALfloat len, char \\*to\)](#)  
[raydium\\_sound\\_verify \(char \\*caller\)](#)  
[raydium\\_texture\\_current\\_set \(GLuint current\)](#)  
[raydium\\_texture\\_current\\_set\\_name \(char \\*name\)](#)  
[raydium\\_texture\\_exists\(char \\*name\)](#)  
[raydium\\_texture\\_filter\\_change \(GLuint filter\)](#)  
[raydium\\_texture\\_find\\_by\\_name \(char \\*name\)](#)  
[raydium\\_texture\\_load \(char \\*filename\)](#)  
[raydium\\_texture\\_load\\_erase \(char \\*filename, GLuint to\\_replace\)](#)  
[raydium\\_texture\\_load\\_internal\(char \\*filename, char \\*as, signed char faked, int faked\\_tx, int faked\\_ty, int faked\\_bpp, int or\\_live\\_id\\_fake\)](#)  
[raydium\\_texture\\_size\\_is\\_correct \(GLuint size\)](#)  
[raydium\\_timecall\\_add \(void \\*funct, GLint hz\)](#)  
[raydium\\_timecall\\_callback \(void\)](#)  
[raydium\\_timecall\\_clock \(void\)](#)  
[raydium\\_timecall\\_detect\\_frequency \(void\)](#)  
[raydium\\_timecall\\_devrtc\\_clock \(void\)](#)  
[raydium\\_timecall\\_devrtc\\_close \(void\)](#)  
[raydium\\_timecall\\_devrtc\\_init \(void\)](#)  
[raydium\\_timecall\\_devrtc\\_rate\\_change \(unsigned long new\\_rate\)](#)  
[raydium\\_timecall\\_freq\\_change \(int callback, GLint hz\)](#)  
[raydium\\_timecall\\_init \(void\)](#)  
[raydium\\_timecall\\_internal\\_w32\\_detect\\_modulo\(int div\)](#)  
[raydium\\_timecall\\_internal\\_w32\\_divmodulo\\_find\(void\)](#)  
[raydium\\_timecall\\_raydium \(GLfloat step\)](#)  
[raydium\\_trigo\\_abs\(a\) \(macro\)](#)  
[raydium\\_trigo\\_cos \(GLfloat i\)](#)  
[raydium\\_trigo\\_cos\\_inv \(GLfloat i\)](#)  
[raydium\\_trigo\\_isfloat\(a\) \(macro\)](#)  
[raydium\\_trigo\\_max\(a,b\) \(macro\)](#)

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raydium_trigo_min(a,b) (macro)  
raydium_trigo_pos_get_modelview (GLfloat * res)  
raydium_trigo_pos_to_matrix (GLfloat * pos, GLfloat * m)  
raydium_trigo_pow2_next(int value)  
raydium_trigo_rotate (GLfloat * p, GLfloat rx, GLfloat ry, GLfloat rz, GLfloat * res)  
raydium_trigo_round(a) (macro)  
raydium_trigo_sin (GLfloat i)  
raydium_trigo_sin_inv (GLfloat i)  
raydium_version(void)  
raydium_vertex_add (GLfloat x, GLfloat y, GLfloat z)  
raydium_vertex_uv_add (GLfloat x, GLfloat y, GLfloat z, GLfloat u, GLfloat v)  
raydium_vertex_uv_normals_add (GLfloat x, GLfloat y, GLfloat z, GLfloat nx, GLfloat ny, GLfloat nz, GLfloat u, GLfloat v)  
raydium_video_callback(void)  
raydium_video_callback_video(int id)  
raydium_video_delete(int id)  
raydium_video_delete_name(char *name)  
raydium_video_find(char *name)  
raydium_video_find_free(void)  
raydium_video_init(void)  
raydium_video_isplaying(int id)  
raydium_video_isplaying_name(char *name)  
raydium_video_isvalid(int i)  
raydium_video_jpeg_decompress(FILE *fp,unsigned char *to)  
raydium_video_loop(int id, signed char loop)  
raydium_video_loop_name(char *name, signed char loop)  
raydium_video_open(char *filename, char *as)  
raydium_window_close (void)  
raydium_window_create (GLuint tx, GLuint ty, signed char rendering, char *name)  
raydium_window_resize_callback (GLsizei Width, GLsizei Height)  
raydium_window_view_perspective(GLfloat fov, GLfloat fnear, GLfloat ffar)  
raydium_window_view_update (void)  
unsupported - int v4l_yuv420p2rgb (unsigned char *rgb_out, unsigned char *yuv_in, int width, int height, int bits)  
unsupported - void dump_vertex_to (char *filename)  
unsupported - void dump_vertex_to_alpha (char *filename)  
unsupported - void read_vertex_from (char *filename)  
unsupported - void v4l_copy_420_block (int yTL, int yTR, int yBL, int yBR, int u, int v, int rowPixels, unsigned char *rgb, int bits)
```

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