

# Multimedia Renderer Developer's Guide



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# About This Guide

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The *Multimedia Renderer Developer's Guide* is intended for developers who want to write multimedia applications that use the `mm-renderer` library to control playback.

This table may help you find what you need in this guide:

To find out about:	Go to:
The main features of the <code>mm-renderer</code> service	<a href="#">Multimedia Renderer Architecture</a> (p. 11)
Using contexts with the multimedia renderer	<a href="#">Working with contexts</a> (p. 25)
Playing media	<a href="#">Media playback</a> (p. 28)
Connecting to <code>mm-renderer</code> and managing contexts to control playback	<a href="#">Multimedia Renderer Client API</a> (p. 41)
Registering for <code>mm-renderer</code> events and retrieving event information	<a href="#">Multimedia Renderer Event API</a> (p. 83)
The dictionary objects that store media property names and values	<a href="#">Dictionary Object API</a> (p. 99)

## Typographical conventions

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Throughout this manual, we use certain typographical conventions to distinguish technical terms. In general, the conventions we use conform to those found in IEEE POSIX publications.

The following table summarizes our conventions:

Reference	Example
Code examples	<code>if( stream == NULL)</code>
Command options	<code>-lR</code>
Commands	<code>make</code>
Constants	<code>NULL</code>
Data types	<code>unsigned short</code>
Environment variables	<b><i>PATH</i></b>
File and pathnames	<code>/dev/null</code>
Function names	<code>exit()</code>
Keyboard chords	<b>Ctrl–Alt–Delete</b>
Keyboard input	<code>Username</code>
Keyboard keys	<b>Enter</b>
Program output	<code>login:</code>
Variable names	<code>stdin</code>
Parameters	<code>parm1</code>
User-interface components	<b>Navigator</b>
Window title	<b>Options</b>

We use an arrow in directions for accessing menu items, like this:

You'll find the Other... menu item under **Perspective** → **Show View**.

We use notes, cautions, and warnings to highlight important messages:



Notes point out something important or useful.



Cautions tell you about commands or procedures that may have unwanted or undesirable side effects.

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Warnings tell you about commands or procedures that could be dangerous to your files, your hardware, or even yourself.

---

**Note to Windows users**

In our documentation, we typically use a forward slash (/) as a delimiter in pathnames, including those pointing to Windows files. We also generally follow POSIX/UNIX filesystem conventions.

## Technical support

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Technical assistance is available for all supported products.

To obtain technical support for any QNX product, visit the Support area on our website ([www.qnx.com](http://www.qnx.com)). You'll find a wide range of support options, including community forums.

# Chapter 1

## Multimedia Renderer Architecture

---

The multimedia rendering component, `mm-renderer`, allows multimedia applications to play audio and video media from files and devices.

The `mm-renderer` service provides mechanisms for:

- specifying the set of media to play
- issuing playback control commands
- retrieving the current playback status
- requesting notifications when the status changes
- providing dynamic metadata (such as position in a track or playlist) for some media content

The multimedia renderer API allows you to control media playback and recording, and to monitor your media operations by receiving events. To examine the system data used by `mm-renderer`, use the Persistent Publish/Subscribe (PPS) API. For more information, see the “[PPS objects](#) (p. 36)” section or the *PPS Developer's Guide*.



The `mm-renderer` service can play media content independently because it directly reads the specified input files without relying on information in databases. You may run `mm-sync` to synchronize media metadata with databases so that your applications can display up-to-date information, but this activity isn't necessary for playing media with `mm-renderer`.

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## Supported media categories

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The `mm-renderer` service supports playback of tracks and playlists. It can play content read either from the local filesystem or through HTTP streams.

A track is an audio or video file such as an MP3 or MP4 file.

A playlist is a list of track URLs. The following types of playlists are supported:

### M3U files

The input URL must be a full path (with or without a `file:` or `http:` prefix) of a file with an M3U extension. In its simplest form, an M3U file is a plain-text file containing the pathnames or URLs of the tracks to play (one per line). Playlists for HTTP Live Streaming (HLS) are supported; these may have M3U and M3U8 file extensions.

### SQL queries

The input URL must be of the form `sql:database?query=querystring`, where `database` is a full path to a database file, and `querystring` is an SQL query that returns a column of track names. If the query contains any reserved characters, they must be URL-encoded (e.g., `%26` instead of `&`).

For the current list of supported media formats, see the *Release Notes* for the QNX SDK for Apps and Media.

## Media sources

You can play audio and video tracks that come from the following sources:

### Files

To play media content from files, specify the path (in POSIX format) of a local file in the input URL (see [mmr\\_input\\_attach\(\)](#) (p. 58) for information on setting the input URL).

### HTTP streams

To play media content from HTTP sources, specify an HLS source or another type of HTTP stream in the input URL. The `mm-renderer` service supports cookies, SSL, and authentication, which enables secure playback of HTTP streams.

## Abstraction layers

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The multimedia renderer uses a layered architecture to process playback commands and manage the flow of media content from input to output.

The `mm-renderer` architecture consists of three abstraction layers:

- The *messaging layer* decodes client messages and delivers them to *contexts*. A context is an object capable of playing one piece of input media at a time on a set of output devices. The input can contain both audio and video signals (e.g., a movie), and the set of outputs can consist of both audio and video devices (e.g., speakers and a screen).
- The *context management layer*:
  - keeps track of the outputs attached to each context
  - maps each output to the engine plugins that can support that output type
  - selects the appropriate engine plugins and attaches them to the context
  - preserves the context state between detaching and reattaching inputs
  - publishes the context state through the PPS service
  - delivers client requests (e.g., *play*) to engine plugins
- The *plugin management layer* keeps track of all available plugins.

## Contexts

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The `mm-renderer` service provides *contexts*, each of which can play a stream of media content concurrently with and independently of other contexts. Each context can direct output to a different set of hardware devices or files, creating independent zones of operation.

The operations that are available for a context at a particular time depend on the input and outputs attached to it. For example, changing playlists won't work unless your input type is a playlist, and seeking to a new track position doesn't apply for some input streams (e.g., radio stations) or devices (e.g., microphones). You can use a context for operations other than playing, by setting its output appropriately. For instance, you can record rather than play an audio stream by setting a context's output to a file and its input to an audio capture device (i.e., a microphone).

Your application must connect to the `mm-renderer` service before it can create a context. When your application creates a context, the context has a unique name but no other properties are set. For subsequent operations, your application accesses the context through the context handle provided by `mm-renderer` when it creates the context. Depending on its configuration, `mm-renderer` may behave differently when closing context handles.

You can control properties of the context's operation (e.g., audio volume) by attaching *parameters* to the context, to the input, or to each of the outputs (for details, see “[Parameters](#) (p. 27)”).

## Outputs

---

Each context has to have one or more outputs attached before it can play anything, so that it can determine where to send the content.

The output can be:

- a file
- an audio device
- a video device

Outputs need to be attached before the input. That's because some engine plugins may determine whether to play an input based on what kind of outputs are attached, and may not support detaching and reattaching outputs after the input is connected.

## Inputs

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Each context has to have one input attached, so it knows what to play.

When an input is attached, the context management layer selects the appropriate engine plugin and attaches it to the context. Your application has to identify the input type for `mm-renderer` because the service doesn't automatically detect the type of the attached input.

The input type determines how `mm-renderer` responds to certain playback requests, such as seeking to a track position or changing playlists. Which input types are supported depends on the configuration of `mm-renderer`; however, the playback behavior for a given input type does *not* depend on the configuration.

Although an input may be attached to more than one context, `mm-renderer` doesn't detect or manage conflicting playback operations. Your application has to manage potential playback conflicts.



## Plugins

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Engine plugins are the components used by `mm-renderer` to process the flow of media data from an input to one or many outputs.

The implementation of the engine plugins is invisible to `mm-renderer` (and its clients). The context management layer selects the appropriate engine plugin based on the types of inputs and outputs attached to the context, and on the rating each engine gives itself for the specified inputs and outputs.



## Chapter 2

# Using the Multimedia Renderer

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The multimedia renderer is a connection-based service that controls the playback of media read from an input and directed to one or many outputs.

Before calling any API functions to start and control playback, you must start `mm-renderer` and your application must connect to the `mm-renderer` service by calling [`mmr\_connect\(\)`](#) (p. 49). Once you have a valid connection handle for `mm-renderer`, your application can create contexts for managing content flows, attach inputs and outputs to those contexts, and issue requests to play media. You can disconnect from `mm-renderer` by calling [`mmr\_disconnect\(\)`](#) (p. 56).

## Starting the multimedia renderer

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The multimedia renderer service is controlled with the `mm-renderer` command utility. Before starting the service, you must prepare a configuration file and set up your PPS state directory.

To start `mm-renderer`:

1. Create and save, in the `/etc/mm/` directory, the configuration file (named `mm-renderer.conf`) to use.

For a sample configuration file, see “[mm-renderer configuration file](#) (p. 20)”.

2. In a QNX Neutrino terminal, enter `pps` to start PPS as a background process. PPS creates a root directory (`/pps` by default) to store the PPS configuration objects, which are text files that provide state, error, and playlist information on the multimedia renderer's current setup.

3. Enter `mkdir -p /pps/services/multimedia/renderer` to create the root directory for holding the PPS objects used by `mm-renderer`.

For an explanation of the PPS objects, see “[PPS objects](#) (p. 36)”.

4. Enter `mm-renderer` followed by any desired options to start the multimedia renderer service.

For debugging purposes, you should start `mm-renderer` with `-vvvvvvv` options to get verbose output. The `-v` option is cumulative, with each additional `v` adding a level of verbosity, up to seven levels.

For an explanation of all command-line options, see “[mm-renderer command utility](#) (p. 22)”.

The PPS and multimedia renderer services are running. Your client application can now use the `mm-renderer` API to control playback.

### mm-renderer configuration file

The multimedia renderer configuration file specifies the plugins to load and the default values for plugin parameters. The path of this file is `/etc/mm/mm-renderer.conf`, and the file must be defined before you start `mm-renderer`.

A single configuration file is used for all instances of `mm-renderer`. Thus, all running instances of the service have the same plugins available, with the same default parameters.



Once started, `mm-renderer` does not support "on-the-fly" configuration changes. To modify the configuration, you must shut down `mm-renderer`, update its configuration file, and restart the service.

---

The configuration file is a text file that gets parsed by `mm-renderer` to load and configure the plugins used in playback. Blank lines are ignored, as is any leading or trailing white space. Lines specifying parameters are in the form `key=value`. Unknown parameter types are ignored and so they can be made into comments. For example, you can enter `My Comment Goes Here` on a line and `mm-renderer` will consider it to be an unsupported parameter and so will ignore that line when parsing the file. However, we recommend using the number sign (`#`) to clearly indicate the start of any comments.

The file is sectioned into different parts, with each configuring one plugin. Sections begin with the `[plugin]` keyword on its own line. The name of the plugin library file is specified on the next line, with the `dll` key. Default values to any parameters supported by the plugin may be specified on the lines that follow.

Suppose you want to use the audio/video player routing plugin, and override the default status update interval of 1000 ms with an update interval of half that time. You would then write a section in the configuration file as follows:

```
# Configure the audio/video player routing plugin
[plugin]
dll=mmr-mmfrouting.so
# Set a half-second (500ms) interval between updates
updateinterval=500
```

Any of the default values set in the configuration file can be overridden by client applications by setting the parameter through the API.

The following plugins and associated parameters are supported:

#### **MMF audio recorder routing plugin**

Library file: `mmr-mmfrouting.so`

There are no parameters for this plugin.

#### **Playlist engine plugin**

Library file: `mmr-playlist-engine.so`

This plugin supports the "playlist" and "autolist" input types, and has the following parameters:

##### **queue\_max**

The maximum number of tracks in the queue window.

##### **tracks\_max**

The maximum number of tracks to keep open.

#### **DLNA playlist engine plugin**

Library file: `mmr-dlnaplaylist-engine.so`

This plugin supports the "dlnatrack" and "dlnaplaylist" input types. There are no parameters for this plugin.

### Single-track engine plugin

Library file: `mmr-track-engine.so`

This plugin supports the "track" input type. There are no parameters for this plugin.

### MMF audio/video player routing plugin

Library file: `mmr-mmf-routing.so`

This plugin has the following parameters:

#### **updateinterval**

The interval between status updates, in milliseconds.

### BB OS audio management plugin

Library file: `mmr-audiomgmt-plugin.so`

This plugin supports the `audio:` output URL, and has the following parameters:

#### **writer**

The filter to use as the audio writer for `audio:` outputs.

### BB OS network connection monitoring plugin

Library file: `mmr-netmgmt-plugin.so`

There are no parameters for this plugin.

## mm-renderer command line

*Configure multimedia renderer context handle policies, PPS objects, and file permissions*

### Synopsis:

```
mm-renderer [-cefoq] -r statepath -s serverpath  
            [-U] {username|uid[:gid[,gid]*]} [-u] [-v[v...]]
```

### Options:

**-c**

Destroy a context when the primary handle is closed.

**-e**

Log to *stderr* instead of *slog*.

**-f**

Stay in the foreground.

**-o**

Disallow the opening of existing contexts (also implies *-c*).

**-q**

Run in quiet mode.

**-r *statepath***

The location of the PPS directory that stores the objects used by the *mm-renderer* process. We refer to this directory as the *PPS state directory*, and the default value is */pps/services/multimedia/renderer*.

If you want to run multiple *mm-renderer* instances, you must use different PPS state directories for each instance by providing different paths with the *-r* option. Running multiple *mm-renderer* instances can improve security. For example, you could run a corporate *mm-renderer* that is accessible to only privileged system processes and a personal *mm-renderer* for use by your client applications. This way, no client could accidentally or intentionally overwrite system memory with buggy or harmful code.

**-s *serverpath***

The full path of the control object in PPS (default: the *control* object in the */pps/services/multimedia/renderer* directory). The value for the *-s* option may be an absolute path or a relative path; for the latter case, the given path will be appended to the PPS state directory path.

**-U { *username* | *uid* [:*gid* [,*gid*]\* ] }**

Run *mm-renderer* with the given username or with the given user ID (*uid*) and possibly one or many group IDs (*gids*). When this option isn't specified, *mm-renderer* uses the client's user ID and group ID.

**-u**

Don't reset the umask. Without this option, the umask is reset to 0 when *mm-renderer* starts.

**-v**

Increase output verbosity. Messages are written to `sloginfo`.

The `-v` option is handy when you're trying to understand the operation of `mm-renderer`, but when lots of `-v` arguments are used, the logging becomes quite significant and can change timing noticeably. The verbosity setting is good for systems under development but should probably not be used in production systems or when performance testing.

**Description:**

The `mm-renderer` command line lets you adjust the context handle and logging policies, override the default PPS control object and the state directories, and assign specific file permissions to output files.

The `mm-renderer` service runs as a server process and responds to media playback commands, and delivers events to clients so they can monitor media operations.



---

## Working with contexts

---

Contexts define the flow of media content from an input to one or many outputs. You must configure a context before you can start playing media content.

To create a new context, call the function [\*mmr\\_context\\_create\(\)\*](#) (p. 50), passing in the `mm-renderer` connection handle. The creation operation returns a context handle (the *primary* handle), which you use to manipulate the context by setting parameters, attaching an input and one or more outputs, and issuing playback commands.

You can create multiple contexts, as long as your application manages potentially conflicting playback situations (e.g., simultaneous requests to play two different tracks from the same CD).

The state of a context is stored in a PPS object. For information on PPS objects, see “[PPS objects](#) (p. 36)”.

When a context is no longer needed, you can explicitly destroy it by passing the context handle to the [\*mmr\\_context\\_destroy\(\)\*](#) (p. 52) function.

### Closing context handles

Depending on `mm-renderer`'s configuration, client applications may be allowed to obtain additional handles to existing contexts. This configuration setting determines `mm-renderer`'s behavior when closing context handles.

Handles obtained by opening existing contexts are called *secondary* context handles, whereas the handle obtained by creating a context is called the *primary* context handle. In addition, `mm-renderer`'s configuration may allow a context to exist after its primary handle has been closed. This is called an *orphan* context. When orphan contexts are allowed, secondary handles are also allowed; however, secondary handles may be allowed when orphan contexts aren't. See the descriptions of the `-c` and `-o` command-line options for further clarification.

The behavior of `mm-renderer` in closing context handles depends on your orphan context policy:

- If orphan contexts are allowed, the only way to close the primary context handle without destroying the context is by explicitly calling [\*mmr\\_context\\_close\(\)\*](#) (p. 49).
- If orphan contexts aren't allowed, there's no way to close the primary handle without destroying the context. In this case, calling [\*mmr\\_context\\_close\(\)\*](#) with the primary context handle is equivalent to calling [\*mmr\\_context\\_destroy\(\)\*](#) (p. 52) because `mm-renderer` will not only close the context handle but also stop playback, detach any inputs and outputs, and destroy the context. Therefore, you must ensure that any secondary context handles, if permitted, are properly closed.

- Regardless of the configuration, if your application terminates unexpectedly or disconnects from `mm-renderer` without explicitly closing the primary context handle, the context is destroyed.

In all circumstances, it's important to properly close unneeded context handles to ensure memory leaks don't occur.

---

## Defining Parameters

---

Parameters allow you to set various properties that influence how media files are accessed and rendered during playback.

Properties such as the audio volume or HTTPS authentication credentials can be controlled by attaching parameters to a context or to its input or any of its outputs. Parameters are represented as *dictionary objects* (collections of key-value pairs), where both the keys and values are strings. The parameters that apply to the context and its input and outputs depend on the media content being played or recorded.

Whether attaching parameters to the context, its input, or one of its outputs, your application has to call [\*strm\\_dict\\_new\(\)\*](#) (p. 112) to create a new dictionary object if none exists. Use [\*strm\\_dict\\_set\(\)\*](#) (p. 112) to set the key-value pairs for the parameters you want to attach.

To attach parameters to the context, call the function [\*mmr\\_context\\_parameters\(\)\*](#) (p. 54), passing in the handle to the dictionary object that holds the context parameters. Similarly, call [\*mmr\\_input\\_parameters\(\)\*](#) (p. 62) to attach input parameters, and call [\*mmr\\_output\\_parameters\(\)\*](#) (p. 71) to attach output parameters. In each case, you must pass in a handle to a separate dictionary object populated with the appropriate key-value pairs.

To update parameters, call the appropriate function again, passing in a handle to a dictionary object populated with the new parameters. Note that the *mmr\_\*\_parameters()* functions replace any previous set of parameters with the latest set, so the caller must keep track of which parameters have been defined. Also, the parameter functions consume the dictionary object handle in each call. If you want to keep the dictionary, call [\*strm\\_dict\\_clone\(\)\*](#) (p. 102) to duplicate the handle before calling a parameter function.

## Playing media

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Playing media in `mm-renderer` requires configuring a context, attaching outputs and an input, and then issuing playback commands. These actions are all done with function calls to the Multimedia Renderer Client API.

*To play media in `mm-renderer`:*

1. Connect to `mm-renderer` using the function [`mmr\_connect\(\)`](#) (p. 49).
2. Create a new context and set the appropriate context parameters. Use the functions [`mmr\_context\_create\(\)`](#) (p. 50) and [`mmr\_context\_parameters\(\)`](#) (p. 54).
3. Attach an output and set its output parameters. Use the functions [`mmr\_output\_attach\(\)`](#) (p. 67) and [`mmr\_output\_parameters\(\)`](#) (p. 71). You can attach multiple outputs.
4. Attach the input and set the input parameters. Use the functions [`mmr\_input\_attach\(\)`](#) (p. 58) and [`mmr\_input\_parameters\(\)`](#) (p. 62).
5. Start playback for the context by calling [`mmr\_play\(\)`](#) (p. 74).

The media starts to play.

### Play states

The possible play states of the context are:

#### **Idle**

No input is attached.

#### **Stopped**

Input is attached but is not playing.

#### **Playing**

Input is attached and is playing.

Note that there is no *paused* play state. Paused playback is represented by a play speed of 0.

### Play speed

In `mm-renderer`, the play speed is represented by an integer. Normal speed is represented by a value of 1000, and 0 means paused. Depending on the context's input media, trick play speeds (i.e., negative, slower than normal, or faster than normal) may not be supported.

Use the [`mmr\_speed\_set\(\)`](#) (p. 76) function to change the current play speed. You can change the speed when the state is *stopped*; `mm-renderer` simply saves the setting and applies it when playback restarts.

## Seeking to positions

Use the [`mmr\_seek\(\)`](#) (p. 75) function to seek to a known position in a single track or a track within a playlist. If the current context input is a track, simply specify the track position in milliseconds, for example "2500". If the context input is a playlist, the position must be a string in the format "99:9999", for example "2:1200", where the first number is the track position in the current playlist and the second number is the number of milliseconds from the beginning of the specified track.

## Managing video windows

You can render video to a display using the Screen Graphics Subsystem library.

The following example shows how to give `mm-renderer` a window group and window ID to use in creating a window on the application's behalf, configure `mm-renderer` for audio and video output, and get a handle to the window and use the Screen API functions to manipulate the output.

To begin, we define the Screen window group and window ID to use for the output. In this example, the same string is used for both: `"videosamplewindowgroup_"` with a random number appended to ensure uniqueness. The window group and window ID are the same in this example, but they don't have to be. We use these two properties to set the output URL, `video_device_url`.

```
app_id = rand();

// Create the video URL for mm-renderer
static char video_device_url[PATH_MAX];

rc = snprintf(video_device_url, PATH_MAX,
              "screen:?winid=videosamplewindowgroup_%d
              &wingrp=videosamplewindowgroup_%d", app_id, app_id);
if (rc < 0) {
    fprintf(stderr, "Error building video device URL string\n");
    return EXIT_FAILURE;
}
else if (rc >= PATH_MAX) {
    fprintf(stderr, "Video device URL too long\n");
    return EXIT_FAILURE;
}

// Create the video context name for mm-renderer
static char video_context_name[PATH_MAX];
...
```

Using the same random number as before, we put the window group name in a variable that we can pass to the `screen_create_window_group()` function. Once the window group is created, we connect to `mm-renderer` and create a context. Finally, we attach the video output to the context by calling `mmr_output_attach()`, specifying the URL variable we set up earlier. We use the same function to attach the audio output.

```
// Window group name, with the same random number appended
static char window_group_name[PATH_MAX];

rc = snprintf(window_group_name, PATH_MAX,
              "videosamplewindowgroup_%d", app_id);
if (rc < 0) {
    fprintf(stderr, "Error building window group name string: \
                  %s\n", strerror(errno));
    return EXIT_FAILURE;
}
else if (rc >= PATH_MAX) {
    fprintf(stderr, "Video context name too long\n");
    return EXIT_FAILURE;
}

// Create the window group for our window. This is important
// because we pass the group name to mm-renderer, which uses it
// to 'parent' its CHILD_WINDOW, which contains the video.
if (screen_create_window_group(
    g_screen_win, window_group_name) != 0) {
    fprintf(stderr, "Error creating window group: %s\n",
            strerror(errno));
    return EXIT_FAILURE;
}

// Configure mm-renderer
mmr_connection = mmr_connect(NULL);
if (mmr_connection == NULL) {
    fprintf(stderr, "Error connecting to renderer service: %s\n",
            strerror(errno));
    return EXIT_FAILURE;
}

mmr_context = mmr_context_create( mmr_connection,
                                  video_context_name,
                                  0,
                                  S_IRWXU|S_IRWXG|S_IRWXO );
if (mmr_context == NULL) {
    fprintf(stderr, "Error creating renderer context: %s\n",
            strerror(errno));
    return EXIT_FAILURE;
}
```

```

// Configure video and audio output
const mmr_error_info_t* errorInfo;
video_device_output_id = mmr_output_attach( mmr_context,
                                             video_device_url,
                                             "video" );

if (video_device_output_id == -1) {
    errorInfo = mmr_error_info(mmr_context);
    fprintf(stderr, "Attaching video output produced error code \
        %d\n", errorInfo->error_code);
    return EXIT_FAILURE;
}

audio_device_output_id = mmr_output_attach( mmr_context,
                                             audio_device_url,
                                             "audio" );

if (audio_device_output_id == -1) {
    // Call mmr_error_info(), display an error message, and exit
    ...
}

```

Next, we retrieve the handle of the video window from the screen event received when the window is created, and check that the ID of the window indicated in the event matches our output video window. For more complicated applications, this is important so that we can distinguish between our video window and another child window belonging to the same window group.

All functions used here are from the Screen API.

```

// Create the screen context, which is needed to retrieve the event
if ( screen_create_context( &screen_ctx,
                           SCREEN_APPLICATION_CONTEXT) != 0 ) {
    fprintf(stderr, "Error creating screen context: %s\n",
            strerror(errno));
    return EXIT_FAILURE;
}

screen_event_t screen_event;
screen_create_event(&screen_event);

// Set a timeout of -1 to block until an event is received
screen_get_event(screen_ctx, screen_event, -1);

int event_type;
screen_get_event_property_iv( screen_event,
                              SCREEN_PROPERTY_TYPE,
                              &event_type );

// Check if it's a creation event and the video output window
// has not yet been initialized
if ((event_type == SCREEN_EVENT_CREATE) &&

```

```
        (video_window == (screen_window_t)NULL)) {
    char id[256];

    rc = screen_get_event_property_pv( screen_event,
                                      SCREEN_PROPERTY_WINDOW,
                                      (void*)&video_window );

    if (rc != 0) {
        fprintf(stderr, "Error reading event window: %s\n",
                strerror(errno));
        return EXIT_FAILURE;
    }

    rc = screen_get_window_property_cv( video_window,
                                       SCREEN_PROPERTY_ID_STRING,
                                       256,
                                       id );

    if (rc != 0) {
        fprintf(stderr, "Error reading window ID: %s\n",
                strerror(errno));
        return EXIT_FAILURE;
    }

    if (strncmp(
        id, window_group_name, strlen(window_group_name)) != 0)
        fprintf(stderr, "Mismatch in window group names\n");
    return EXIT_FAILURE;
}
...

```

Once we have this handle we can manipulate the video window directly with Screen API calls.

```
// Set the z-order of the video window to put it above or below
// the main window. Alternate between +1 and -1 to implement
// double-buffering to avoid flickering of output.
app_window_above = !app_window_above;
if (app_window_above) {
    screen_val = 1;
}
else {
    screen_val = -1;
}

if (screen_set_window_property_iv( video_window,
                                  SCREEN_PROPERTY_ZORDER,
                                  &screen_val ) != 0) {
    fprintf(stderr, "Error setting z-order of video window: %s\n",
            strerror(errno));
    return EXIT_FAILURE;
}

```



```
// Set the video window to be visible.
screen_val = 1;
if (screen_set_window_property_iv( video_window,
                                   SCREEN_PROPERTY_VISIBLE,
                                   &screen_val) != 0 ) {
    fprintf(stderr, "Error making window visible: %s\n",
            strerror(errno));
    return EXIT_FAILURE;
}
...
```

## Recording audio data

---

You can record audio content in `mm-renderer` by attaching the input to an audio capture device and directing the output to a file instead of a device.

The following sample program shows how to give `mm-renderer` an input URL of type `snd:` to select and configure an audio capture device (microphone), set an output URL type of `file:` to target a file, and then start and stop playback to record captured audio content to the targetted file. The `snd:` input URL format works only with the `file:` output type, so your code must obey this design.

You can record audio content for as long as you like, but you must ensure your client application's output file can hold all the content you want to capture. The size of the generated output depends on many settings, including the sampling rate and number of channels. This sample program records in mono by specifying one channel (`nchan=1`) in the input URL. Depending on your platform, your microphone device might have two recorders, so you could record in stereo by setting two channels (`nchan=2`). You could also increase the sampling rate to attain the necessary audio quality, such as using the standard CD sampling rate of 44.1 MHz (`frate=44100000`). For more information on the available device options, see the [list of URL parameters for audio capture devices](#) (p. 60).

This code sample names an AMR file for the output, but `mm-renderer` supports other formats, such as wideband AMR (see the [list of supported output file formats](#) (p. 69)).

```
void record_AMR_file()
{
    mmr_connection_t *connection;
    mmr_context_t *context;
    const char* context_name = "AnyNameYouWant";
    int output = 0;
    const char* outputFile = "/tmp/testFile.amr";
    int input = 0;

    connection = mmr_connect(NULL);

    if (connection) {
        context = mmr_context_create( connection,
                                     context_name,
                                     0,
                                     S_IRWXU );

        if (context) {
            // specify a file output so the audio content is
            // not played but recorded in a file
            output = mmr_output_attach( context,
```

```
        outputFile,
        "file" );

    // specify the audio device under /dev/snd you want to
    // use for the recording, and the recording details
    // (in this case, we use a sampling rate of 8000 Hz and
    // 1 channel for mono (not stereo) recording)
    input = mmr_input_attach( context,
        "snd:/dev/snd/pcmPreferredc?nchan=1&frate=8000",
        "track" );

    // start recording
    mmr_play(context);

    // delay for the length of time you want to record
    // (in this case, 30 seconds)
    sleep(30);

    // stop recording
    mmr_stop(context);

    // clean up the context
    mmr_input_detach(context);
    mmr_output_detach(context, output);
    mmr_context_destroy(context);
}
mmr_disconnect(connection);
} // if (connection)
} // function
```

## PPS objects

---

The multimedia renderer stores a variety of information using Persistent Publish/Subscribe (PPS) objects.

PPS objects are implemented as files in a special filesystem. The PPS objects created by `mm-renderer` are located in subdirectories under the PPS root directory (`/pps/services/multimedia/renderer`).

These objects store information about:

- context state
- play state, warnings, and errors
- input metadata
- playlists
- supported file types

To get information from PPS objects, you can use the POSIX `open()` and `read()` functions, or you can use functions from the PPS encoding and decoding API, which is explained in the *PPS Developer's Guide*.

The attributes of some objects (for example, the `status` object) may be refreshed very frequently, so you shouldn't use delta mode to read those objects. For more information about delta mode, see the "Subscription Modes" section in the *PPS Developer's Guide*.

### Context state

Every time you create a context by calling `mmr_context_create()`, `mm-renderer` also creates a context directory with the same name. For instance, creating a context named `movie1` creates a directory named `/pps/services/multimedia/renderer/context/movie1`.

Inside each context directory, `mm-renderer` creates several objects (files) that hold the state of the context. When an input is attached to the context, additional objects may be created in the context directory, depending on the input type.

The state of a context is represented by the following objects (files), where the # character indicates a numeric value encoded as decimal:

- `param` — contains the parameters set with `mmr_context_parameters()`.
- `output#` — created when an output is attached; deleted when detached. The # token is the output ID returned by `mmr_output_attach()`. This object contains the URL, output type, and the latest parameters set with `mmr_output_parameters()`.

- `input` — populated when an input is attached, emptied when detached. This object contains the URL, input type, and the latest parameters set with `mmr_input_parameters()`.
- `status` — a snapshot of the current status. This is potentially high bandwidth, so delta mode shouldn't be used to read this object. This object holds information on the playback position, the buffer capacity, and the buffer activity.
- `state` — the play state. This object is intended to be read in delta mode, otherwise errors or warnings may be lost. The `state` object may have the following attributes, depending on the play state:
  - `state` — `playing`, `stopped`, or `idle`
  - `speed` — the current set speed in units of 1/1000th of normal speed
  - `warning` — the most recent warning (deleted when playback is stopped)
  - `warning_pos` — the play position when the warning happened
  - `error` — the most recent error code (deleted when playback is restarted)
  - `error_pos` — the play position when the error happened

## Play state, warnings, and errors

To detect changes in the play state, read the `state` object in delta mode.

The `state` object is updated based on input attachment and playback events, as follows:

- When there's no input attached, the `state` attribute (within the `state` object) is `idle`, and no other attributes are present.
- When an input is attached, the `state` attribute changes from `idle` to `stopped`.
- When playback begins, the `state` attribute changes from `stopped` to `playing`, and any `error` and `error_pos` attributes are deleted.
- When the end of media is reached, the `state` attribute changes from `playing` to `stopped`, and the `error` attribute is set to `MMR_ERROR_NONE`.
- When playback is explicitly stopped by a function call, no error code is published to the `state` object.

A warning is a problem that doesn't stop playback. If there's a warning, the `state` remains as `playing`, and the `warning` and `warning_pos` attributes are set.

An error is a problem that stops playback. If there's an error:

- the `warning` and `warning_pos` attributes, if any, are deleted
- the `state` attribute is set to `stopped`
- the `error` and `error_pos` attributes are set

## Input metadata

To get metadata for the main input, read the `metadata` object, which `mm-renderer` creates in the corresponding PPS context directory when an input is attached to a context.

When the main input is a track played independently or a playlist, the `metadata` object stores attributes that correspond to the main input's metadata fields. For example, the `metadata` object for an audio track has attributes such as `md_title_album`, `md_title_artist`, `md_title_bitrate`, and so on.

When the main input is an *autolist*, which is a single track formatted as a playlist, the `metadata` object stores only the URL of the track.

To get metadata for media tracks that are playlist or autolist entries, read the `q#` objects, which are stored in the same PPS context directory. There is one `q#` object for each playlist entry, where the `#` token is the position of the track in the playlist (starting from 1). For autolists, there is only the `q1` object. The metadata attributes for a track are set when the track begins to play.

## Playlist window

When the context input is a playlist, `mm-renderer` creates additional PPS objects in the context directory. These PPS objects specify the currently playing item and the items in front of and behind the current item, up to a preconfigured maximum; this information is collectively known as the *playlist window*.

The following PPS objects represent the playlist window:

- `p#` — contains the track parameters for one playlist entry. There is one `p#` object for each playlist entry, where the `#` token is the position of the track in the playlist (starting from 1). Each such object contains the latest parameters passed into `mmr_track_parameters()` for the corresponding track.
- `play-queue` — represents the size of the playlist window. The `play-queue` object has the following attributes:
  - `start` — the index of the first `p#` item in the window
  - `end` — the index of the last `p#` item in the window
  - `total` — the total number of items in the playlist; set once a track is played



If you seek to a track outside of the playlist window, the indexes of the first and last items may retain stale values for a short time after the seek command is issued. This is because these attributes are updated asynchronously.

---

## Supported file and MIME types

The `/pps/services/multimedia/renderer/component` directory contains the `.all` object, which lists supported file extensions and MIME types. To access this information, examine the following attributes in the `.all` object:

- `audioencodeextensions` — lists supported filename extensions for file outputs, in a comma-separated list (for example, "m4a,wav")
- `mime` — lists allowed combinations of playable MIME types, in a comma-separated list (for example, "3gpp,video")

Applications should be prepared to merge value sets listed in multiple instances of the same attribute.





## Chapter 3

# Multimedia Renderer Client API

---

The multimedia renderer Client API exposes the functions you can use to connect to `mm-renderer`, create contexts, attach inputs and outputs, and manage playback.

The Client API lets you manage the flow of media content with functions for setting the input, for directing the output to an audio or video device or to a file, and for starting or stopping the media flow. You can also define parameters for inputs, outputs, contexts, and tracks. These parameters are specified with dictionary objects that are passed in to API calls (see the “[Dictionary Object API](#) (p. 99)” section for details on dictionary objects).

The header file that defines the Client API functions, `renderer.h`, is located in `/${QNX_TARGET}/usr/include/mm/` on the development system (not the target). The header file that defines the enumerated error codes and the Client API data types, `types.h`, is located in `/${QNX_TARGET}/usr/include/mm/renderer/` on the development system (not the target).

## Data types in `renderer.h` and `types.h`

---

Client API data types in the `mmrndclient` library.

### `mm_error_code_t`

*Error codes set by Client API functions.*

#### Synopsis:

```
#include <mm/renderer/types.h>

typedef enum mm_error_code {
    MMR_ERROR_NONE,
    MMR_ERROR_UNKNOWN,
    MMR_ERROR_INVALID_PARAMETER,
    MMR_ERROR_INVALID_STATE,
    MMR_ERROR_UNSUPPORTED_VALUE,
    MMR_ERROR_UNSUPPORTED_MEDIA_TYPE,
    MMR_ERROR_MEDIA_PROTECTED,
    MMR_ERROR_UNSUPPORTED_OPERATION,
    MMR_ERROR_READ,
    MMR_ERROR_WRITE,
    MMR_ERROR_MEDIA_UNAVAILABLE,
    MMR_ERROR_MEDIA_CORRUPTED,
    MMR_ERROR_OUTPUT_UNAVAILABLE,
    MMR_ERROR_NO_MEMORY,
    MMR_ERROR_RESOURCE_UNAVAILABLE,
    MMR_ERROR_MEDIA_DRM_NO_RIGHTS,
    MMR_ERROR_DRM_CORRUPTED_DATA_STORE,
    MMR_ERROR_DRM_OUTPUT_PROTECTION,
    MMR_ERROR_DRM_OPL_HDMI,
    MMR_ERROR_DRM_OPL_DISPLAYPORT,
    MMR_ERROR_DRM_OPL_DVI,
    MMR_ERROR_DRM_OPL_ANALOG_VIDEO,
    MMR_ERROR_DRM_OPL_ANALOG_AUDIO,
    MMR_ERROR_DRM_OPL_TOSLINK,
    MMR_ERROR_DRM_OPL_SPDIF,
    MMR_ERROR_DRM_OPL_BLUETOOTH,
    MMR_ERROR_DRM_OPL_WIRELESSHD,
    MMR_ERROR_DRM_OPL_RESERVED_LAST =
        MMR_ERROR_DRM_OPL_WIRELESSHD + 4,
    MMR_ERROR_MEDIA_DRM_EXPIRED_LICENSE,
    MMR_ERROR_PERMISSION,
    MMR_ERROR_COUNT,
} mm_error_code_t;
```

#### Data:

##### **MMR\_ERROR\_NONE**

No error has occurred. This error code is used for the EOF event but never returned as the error code from an API call.

##### **MMR\_ERROR\_UNKNOWN**

An unexpected error.

**MMR\_ERROR\_INVALID\_PARAMETER**

An invalid parameter, such as an invalid output ID or a seek string that's incorrectly formatted or out of range.

**MMR\_ERROR\_INVALID\_STATE**

An illegal operation given the context state, such as attempt to play or seek when no input is attached, to change the playlist when playback was stopped, or to access the context after it's been destroyed.

**MMR\_ERROR\_UNSUPPORTED\_VALUE**

An unrecognized input or output type or an out-of-range speed setting.

**MMR\_ERROR\_UNSUPPORTED\_MEDIA\_TYPE**

An unrecognized data format.

**MMR\_ERROR\_MEDIA\_PROTECTED**

The file is DRM-protected and either it uses an unsupported DRM scheme or there's a DRM error not corresponding to any of the errors listed below.

**MMR\_ERROR\_UNSUPPORTED\_OPERATION**

An illegal operation. This error is returned if you try to seek or to set the playback speed on media that doesn't allow it, or you try to attach an output after attaching the input but the underlying media doesn't support that action sequence.

**MMR\_ERROR\_READ**

An I/O error at the source.

**MMR\_ERROR\_WRITE**

An I/O error at the sink.

**MMR\_ERROR\_MEDIA\_UNAVAILABLE**

`mm-renderer` can't open the source.

**MMR\_ERROR\_MEDIA\_CORRUPTED**

`mm-renderer` found corrupt data on the media.

**MMR\_ERROR\_OUTPUT\_UNAVAILABLE**

`mm-renderer` can't write to the output (possibly because the output URL or type doesn't match any supported sink).

**MMR\_ERROR\_NO\_MEMORY**

Insufficient memory to perform the requested operation.

**MMR\_ERROR\_RESOURCE\_UNAVAILABLE**

A required resource such as an encoder or an output feed is presently unavailable.

**MMR\_ERROR\_MEDIA\_DRM\_NO\_RIGHTS**

The client lacks the rights to play the file.

**MMR\_ERROR\_DRM\_CORRUPTED\_DATA\_STORE**

The DRM data store is corrupted.

**MMR\_ERROR\_DRM\_OUTPUT\_PROTECTION**

A DRM output protection mismatch on an unspecified output.

**MMR\_ERROR\_DRM\_OPL\_HDMI**

A DRM output protection mismatch on an HDMI output.

**MMR\_ERROR\_DRM\_OPL\_DISPLAYPORT**

A DRM output protection mismatch on a DISPLAYPORT output.

**MMR\_ERROR\_DRM\_OPL\_DVI**

A DRM output protection mismatch on a DVI output.

**MMR\_ERROR\_DRM\_OPL\_ANALOG\_VIDEO**

A DRM output protection mismatch on a video ANALOG output (e.g., S-VIDEO, COMPOSITE, RGB, RGBHW, YPbPr).

**MMR\_ERROR\_DRM\_OPL\_ANALOG\_AUDIO**

A DRM output protection mismatch on an audio ANALOG output (e.g., HEADPHONE, SPEAKER OUT).

**MMR\_ERROR\_DRM\_OPL\_TOSLINK**

A DRM output protection mismatch on a TOSLINK output.

**MMR\_ERROR\_DRM\_OPL\_SPDIF**

A DRM output protection mismatch on an S/PDIF output.

**MMR\_ERROR\_DRM\_OPL\_BLUETOOTH**

A DRM output protection mismatch on a BLUETOOTH output.

**MMR\_ERROR\_DRM\_OPL\_WIRELESSHD**

A DRM output protection mismatch on a WIRELESSHD output.

**MMR\_ERROR\_DRM\_OPL\_RESERVED\_LAST**

Identifier marking the end-of-range for MMR\_ERROR\_DRM\_OPL\_\* values.

**MMR\_ERROR\_MEDIA\_DRM\_EXPIRED\_LICENSE**

A license for the DRM file was found but has expired, either because the play count has been depleted or the end time has passed.

**MMR\_ERROR\_PERMISSION**

A playback permission error (e.g., user prohibition, region mismatch).

**MMR\_ERROR\_COUNT**

An end-of-list identifier. Also indicates the number of distinct error codes.

**Library:**

`mmrndclient`

**Description:**

The enumerated type `mm_error_code_t` defines the error codes returned by Client API functions.

**Classification:**

QNX Neutrino

***mmr\_connection\_t***

*The mm-renderer connection handle type.*

**Synopsis:**

```
#include <mm/renderer.h>
typedef struct mmr_connection mmr_connection_t;
```

**Library:**

`mmrndclient`

**Description:**

The structure `mmr_connection_t` is a private data type representing the connection to mm-renderer.

**Classification:**

QNX Neutrino

***mmr\_context\_t****The mm-renderer context handle type.***Synopsis:**

```
#include <mm/renderer.h>
typedef struct mmr_context mmr_context_t;
```

**Library:**`mmrndclient`**Description:**

The structure `mmr_context_t` is a private data type representing a context handle.

Your application can monitor changes to the context state by using the Event API functions. For details about these functions, see the [Multimedia Renderer Event API](#) (p. 83) chapter.

**Classification:**

QNX Neutrino

***mmr\_error\_info\_t****The mm-renderer error information.***Synopsis:**

```
#include <mm/renderer/types.h>
typedef struct mmr_error_info {
    uint32_t error_code;
    char extra_type[ 20 ];
    int64_t extra_value;
    char extra_text[ 256 ];
} mmr_error_info_t;
```

**Data:*****uint32\_t error\_code***

One of the [mm\\_error\\_code\\_t](#) (p. 42) constants.

***char extra\_type[ 20 ]***

A short string identifying the API or protocol that defines the meaning of *extra\_value*, such as "errno", "http", or "mmf".

***int64\_t extra\_value***

An error number according to *extra\_type*.

***char extra\_text[ 256 ]***

Free-form text describing the error. This may or may not have a format formally defined by a specification. For example, when *extra\_type* is "http", this field contains an HTTP server response string.

**Library:**

`mmrndclient`

**Description:**

The structure `mmr_error_info_t` contains error information generated by `mm-renderer` functions. Use the function `mmr_error_info()` to retrieve error information for a particular context and function call.

This multifield structure allows plugins to return protocol- or API-specific error information in addition to the MMR error code. The *extra\_type* string is a tag that specifies how to interpret the *extra\_value* and *extra\_text* fields.

The values of *extra\_type* currently supported are:

<code>extra_type</code>	<code>extra_value</code>	<code>extra_text</code>
" " (empty)	0	Usually empty, possibly some descriptive text
"errno"	An <i>errno</i> value	Usually the result of <code>strerror(extra_value)</code> , but possibly something more descriptive
"mmf"	One of the MMF-specific error codes (not a valid <i>errno</i> )	Usually empty, but possibly something more descriptive
"http"	An HTTP response code	An HTTP server response
"libcurl"	A <code>libcurl</code> error code (but not <code>CURLE_HTTP_RETURNED_ERROR</code> )	The corresponding <code>libcurl</code> error message

**Classification:**

QNX Neutrino

## Functions in `renderer.h`

---

Client API functions in the `mmrndclient` library.

### ***mmr\_command\_send()***

*Send a remote control command to the context.*

#### **Synopsis:**

```
#include <mm/renderer.h>

int mmr_command_send( mmr_context_t *ctxt,
                     const char *cmd )
```

#### **Arguments:**

***ctxt***

A context handle.

***cmd***

The command to send.

#### **Library:**

`mmrndclient`

#### **Description:**

Send a remote control command to the context. The commands available depend on the plugin in use.

This function is offered for future use; currently, no commands are defined.

#### **Returns:**

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

#### **Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes



***mmr\_connect()***

*Connect to mm-renderer.*

**Synopsis:**

```
#include <mm/renderer.h>

mmr_connection_t* mmr_connect( const char *name )
```

**Arguments:*****name***

The name of the `mm-renderer` service to connect to (use `NULL` for the default service).

**Library:**

`mmrndclient`

**Description:**

Connect to `mm-renderer`, using the specified name if *name* isn't `NULL`, returning a valid connection handle on success.

**Returns:**

A connection handle, or `NULL` on failure (*errno* is set).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_context\_close()***

*Close a context.*

**Synopsis:**

```
#include <mm/renderer.h>

int mmr_context_close( mmr_context_t *ctxt )
```

**Arguments:***ctxt*

A context handle.

**Library:**`mmrndclient`**Description:**

Close and invalidate the context handle. The handle passed to `mmr_context_close()` always gets closed and becomes invalid, even if the function returns an error. If the primary handle (which was returned by `mmr_context_create()`) is passed in, the associated context might be destroyed, depending on the configuration. If this is the case, the function fails and sets the global variable `errno` to `EPERM`.

**Returns:**Zero on success, -1 on failure (check `errno`). The handle becomes invalid either way.**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_context\_create()****Create a context.***Synopsis:**

```
#include <mm/renderer.h>

mmr_context_t* mmr_context_create(
    mmr_connection_t *connection,
    const char *name,
    unsigned flags,
    mode_t mode )
```

**Arguments:***connection*

An `mm-renderer` connection handle.

***name***

The name of the context. This must be a valid filename and will show up in the pathname space as a directory.

***flags***

Must be zero. No flags are defined for now.

***mode***

Permission flags controlling which processes can access the context. These flags are specified in a standard POSIX permissions bitfield.

The `w` bits control which processes can open secondary handles to access the context. The `r` and `x` bits provide access to `mm-renderer` events related to the context.

In this bitfield, the user permissions apply to the caller and to any process with the same effective user ID (`euid`). You must set these permissions appropriately to grant your application (or other applications running with the same `euid`) sufficient access to the context being created. The group permissions apply to processes with an effective group ID (`egid`) or a supplementary group ID matching the caller's `egid`. The other permissions apply to all other processes.

**Library:**

`mmrndclient`

**Description:**

Create and open a new context with the specified name. Fail if a context with that name already exists. The name must be a valid filename and will show up as a directory in the pathname space, with its file permissions set based on the `mode` argument. Note that there's not a direct mapping between the value given in `mode` and the file permissions assigned to the context directory. For an explanation of how the permissions specified in the function call are interpreted, see the [mode](#) (p. 51) argument.

When successful, the function returns a handle, called the *primary* handle, for accessing the newly created context. Depending on your configuration, you may be able to create any number of secondary handles by calling [mmr\\_context\\_open\(\)](#) (p. 53).

To avoid memory leaks, every handle opened with `mmr_context_create()` needs to be closed, either explicitly through an API call or implicitly by terminating the process. The `mm-renderer` configuration also determines whether closing the primary handle

also destroys the context. If this option is set and you do close the primary handle of a context, you can no longer use any secondary handles to that context, so you must close those handles by calling `mmr_context_close()` (p. 49) on each one. If this option isn't set, you can call `mmr_context_close()` to close the primary handle without destroying the context, which lets you keep using that context by accessing it with secondary handles.

**Returns:**

A handle on success, or a null pointer on failure (check `errno`).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_context\_destroy()***

*Destroy a context.*

**Synopsis:**

```
#include <mm/renderer.h>

int mmr_context_destroy( mmr_context_t *ctxt )
```

**Arguments:**

***ctxt***

A context handle.

**Library:**

`mmrndclient`

**Description:**

Destroy the context the handle refers to and close the handle. Implicitly stop any playback and detach any input or outputs. If any other handles to this context still exist, attempts to use them will fail. At this point, you should close those handles by calling `mmr_context_close()` on each one.

In addition to calling `mmr_context_destroy()`, you can destroy a context in these ways:

- calling `mmr_context_close()` using the primary handle (if your configuration disallows orphan handles)
- calling `mmr_disconnect()` (if you have the primary handle)
- terminating the process (if you have the primary handle)

**Returns:**

Zero on success, -1 on failure (check `errno`). The handle becomes invalid either way.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_context\_open()***

*Open an existing context.*

**Synopsis:**

```
#include <mm/renderer.h>

mmr_context_t* mmr_context_open(
    mmr_connection_t *connection,
    const char *name )
```

**Arguments:**

***connection***

An `mm-renderer` connection handle.

***name***

The context name.

**Library:**

`mmrndclient`

**Description:**

Open a handle to an existing context. The handle returned by this function is called a *secondary* handle.

Whether this operation is allowed depends on the options that you define for the `mm-renderer` process (for details, see “[mm-renderer command line](#) (p. 22)”). If you set these options to disallow the opening of secondary handles, this function fails and sets the global variable `errno` to `EPERM`. If these options allow the opening of secondary handles, you can open as many as you like, and the function will return a new handle with each successful call.

To avoid memory leaks, every handle opened with `mmr_context_open()` needs to be closed, either explicitly through an API call or implicitly by terminating the process.

**Returns:**

A handle on success, or a null pointer on failure (check `errno`).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_context\_parameters()***

*Set context parameters.*

**Synopsis:**

```
#include <mm/renderer.h>

int mmr_context_parameters( mmr_context_t *ctxt,
                           strm_dict_t *parms )
```

**Arguments:**

***ctxt***

A context handle.

***parms***

A dictionary containing the context parameters to set (must not be NULL). Any previous parameters are overridden.

The `strm_dict_t` object becomes API property after this call, even if the call fails. You should not use or destroy the dictionary after passing it to this function.

**Library:**

`mnrndclient`

**Description:**

Set parameters associated with the specified context. The applicable parameters and their types and values are implementation-specific. For example, different input and output types may require different parameters associated with the context. In general, the following parameter is supported:

***updateinterval***

Allows an application to request a particular frequency in status updates from `mm-renderer`. How accurately this delivery reflects the *updateinterval* setting depends on the plugin handling the media flow. Currently, this parameter is supported only for the MMF audio/video player routing plugin. The default update interval is 1000 ms, but your client code should dynamically adjust this parameter based on the application's state, such as fullscreen versus minimized versus when the screen is off. You can also override this parameter in the configuration file.

QNX Neutrino RTOS supports the following parameters that map to `libcurl` options:

- `OPT_VERBOSE`
- `OPT_CONNECTTIMEOUT_MS`
- `OPT_LOW_SPEED_LIMIT`
- `OPT_LOW_SPEED_TIME`
- `OPT_USERAGENT`
- `OPT_USERNAME`
- `OPT_PASSWORD`
- `OPT_PROXYUSERNAME`
- `OPT_PROXYPASSWORD`
- `OPT_COOKIE`
- `OPT_COOKIEFILE`
- `OPT_COOKIEJAR`
- `OPT_COOKIESESSION`

- `OPT_CAINFO`
- `OPT_CAPATH`
- `OPT_SSL_VERIFYPEER`
- `OPT_SSL_VERIFYHOST`
- `OPT_PROXY`
- `OPT_NOPROXY`
- `OPT_HTTPPROXYTUNNEL`
- `OPT_PROXYPORT`
- `OPT_PROXYTYPE`
- `OPT_PROXYAUTH`
- `OPT_HTTPAUTH`
- `OPT_HTTPHEADER`
- `OPT_DNSCACHETIMEOUT`

QNX Neutrino RTOS supports the following parameters that map to socket options (see the `getsockopt()` function in the *C Library Reference* for more information):

- `OPT_SO_RCVBUF`
- `OPT_SO_SNDBUF`

**Returns:**

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_disconnect()***

*Disconnect from mm-renderer.*

**Synopsis:**

```
#include <mm/renderer.h>

void mmr_disconnect( mmr_connection_t *connection )
```



**Arguments:*****connection***

An `mm-renderer` connection handle.

**Library:**

`mmrndclient`

**Description:**

Disconnect from `mm-renderer`. Close any existing context handles associated with the connection being closed and free their memory. You shouldn't use these handles again, not even in an API call to close them. If any of them are primary handles, their contexts also get destroyed.

The same happens in terms of contexts being destroyed if your application exits without explicitly disconnecting. This means you don't have to clean up old contexts when you restart the application.

Each context handle is associated with the connection handle used to create it. This means that if you have multiple connections to `mm-renderer`, calling `mmr_disconnect()` to close one of those connections doesn't necessarily close all your context handles.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_error\_info()***

*Get error information.*

**Synopsis:**

```
#include <mm/renderer.h>

const mmr_error_info_t* mmr_error_info( mmr_context_t *ctxt )
```

**Arguments:*****ctxt***

A context handle.

**Library:**

`mmrndclient`

**Description:**

Return error information. Return a pointer to an internal buffer containing error information about the most recent API call made using the same context handle. The pointer and the error information it points to are valid only until another API call is made.

**Returns:**

Pointer to error information, or a null pointer if the most recent API call succeeded.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_input\_attach()***

*Attach an input.*

**Synopsis:**

```
#include <mm/renderer.h>

int mmr_input_attach( mmr_context_t *ctxt,
                    const char *url,
                    const char *type )
```

**Arguments:**

***ctxt***

A context handle.

***url***

The URL of the new input.

***type***

The input type. You must place quotes around the text naming the input type, which can be one of the following:

**`track`**

One track played in isolation from the rest of the media

**`playlist`**

A track sequence, with ordering information and track metadata contained in a playlist file

**`autolist`**

A single track formatted as a playlist; you can play the track continuously using the *repeat* parameter

**Library:**

`mmrndclient`

**Description:**

Attach an input file, device, or playlist. If the context already has an input, the function detaches it first.

The input type determines how `mm-renderer` responds to certain playback requests. For example, when seeking to track positions using [`mmr\_seek\(\)`](#) (p. 75), you must specify the desired position differently for each of the supported input types. Also, [`mmr\_list\_change\(\)`](#) (p. 65) and [`mmr\_track\_parameters\(\)`](#) (p. 79) apply to "playlist" only.

Which input types are supported depends on the configuration of `mm-renderer`; however, the playback behavior for a given input type does *not* depend on the configuration.

Valid input URLs for the "track" and "autolist" input types are:

- A URL starting with `http:` or `https:`. HTTP Live Streaming (HLS) is supported just as any HTTP stream, with the following caveats:
  - For HLS realtime broadcast, the seek operation is disabled. Therefore, if your application issues a seek command it will fail.
  - Pause (play speed of 0) is supported but the playback may jump forward when resumed because the current stream may have become unavailable.
  - For HLS Video on Demand, the seek operation places the play position at the start of the video chunk that is closest to the requested time. The pause operation works as expected.

The `mm-renderer` service supports HLS version 3, with media segments encoded as follows:

- Transport stream MPEG2-TS with H.264 Video, with either MP3 or AAC Audio (when the appropriate codecs are available on the platform)
- Video only and audio only when embedded in the MPEG2-TS stream



For secure video and audio playback of HTTP streams, `mm-renderer` allows you to set cookies, SSL, and authentication properties by defining context, input, or track parameters (see [`mmr\_context\_parameters\(\)`](#) (p. 54), [`mmr\_input\_parameters\(\)`](#) (p. 62), and [`mmr\_track\_parameters\(\)`](#) (p. 79) for more information).

- 
- A full pathname starting with a "/" character, with or without a `file:` or `http:` prefix. The pathname may refer to an audio or a video file.
  - A `file2b:` URL containing the full pathname of a dynamically growing file (a *progressive download*). Not all formats are supported. If parsing the file requires knowing its size or reading more data than currently in the file, the input attachment operation may fail. If it succeeds, any attempt to play from beyond the end of file will cause the playback to underrun. Your application must pay attention to the buffering status and appropriately present the state to the user, depending on whether the download is happening at the same time.
  - An `snd:` URL targeting an audio capture device (microphone) whose device file is located in `/dev/snd`. The URL can specify device configuration options in a comma-separated list, as follows:

```
snd:/dev/snd/pcmPreferredc?frate=44100&nchan=2
```

Supported options include:

- `frate` — the sampling rate, in Hertz
- `frag_ms` — the fragment size, in milliseconds
- `nchan` — the number of channels (1 for mono, 2 for stereo)
- `depth` — the number of bits per sample (e.g., 16)
- `bsize` — the preferred read size, in bytes

Currently, this URL format works only with the "file" output type. The resulting behavior is identical to that for the `audio:` URL format except that the Audio Manager is bypassed, which means you can't provide hints such as audio type to control audio routing. The advantage of the `snd:` prefix is that you can use it on systems that don't have Audio Manager.

- An `audio:` URL naming an audio capture device (microphone) whose name is defined by the `AUDIO_DEVICE_NAMES` set of string constants, which is listed in

the *Audio Manager Library* reference. The URL can specify any of the options supported for `snd`: URLs, for example:

```
audio:voice?nchan=1&frate=44100&depth=16
```

Currently, this URL format works only with the "file" output type. Client applications should use `audio:default` to specify automated routing for the audio stream unless there's a good reason to use one particular device. When a non-default device is named, the audio stream routing depends solely on that device. For instance, the removal of the device could result in no audio being outputted or an error returned to the client.

Valid input URLs for the "playlist" input type are:

- A full pathname of an M3U playlist file, with or without a `file:` or `http:` prefix
- An SQL URL in the form `sql:database?query=query`, where:
  - `database` is the full path to the database file
  - `query` must return a single column containing URLs in a form acceptable for the "track" input type
  - any special characters in the query must be URL-encoded (e.g., spaces encoded as `%20`, and so on)



Not all audio devices may work with the current application. It's the client's responsibility to determine if a particular device is supported before trying to use it. See the [mmr\\_output\\_attach\(\) example](#) (p. 69) for a demo of how to check if an audio device is supported before configuring the audio routing.

#### Returns:

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

#### Classification:

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

#### Example:

See the [mmr\\_output\\_attach\(\) example](#) (p. 69) for a demo of how to select one audio device to use.

***mmr\_input\_detach()***

*Detach an input.*

**Synopsis:**

```
#include <mm/renderer.h>

int mmr_input_detach( mmr_context_t *ctxt )
```

**Arguments:**

***ctxt***

A context handle.

**Library:**

`mmrndclient`

**Description:**

Detach any input. If the context is playing, stop it first. If there is no input already, this is a no-op.

**Returns:**

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_input\_parameters()***

*Set input parameters.*

**Synopsis:**

```
#include <mm/renderer.h>

int mmr_input_parameters( mmr_context_t *ctxt,
                          strm_dict_t *parms )
```

**Arguments:*****ctxt***

A context handle.

***parms***

A dictionary containing the input parameters to set (must not be NULL). Any previous parameters are overridden.

The `strm_dict_t` object becomes API property after this call, even if the call fails. You should not use or destroy the dictionary after passing it to this function.

**Library:**

`mmrndclient`

**Description:**

Set parameters associated with the attached input.

Some `mm-renderer` plugins don't return errors when you provide unacceptable values for input parameters. Instead, these plugins revert bad parameters to their previous values or to their default values (for parameters that you set for the first time). To see which values were accepted or changed, client applications can examine the parameters that the Event API returned.

The input type and the URL format determine which input parameters you can set. Some parameters must be set before the input is attached, because setting them after attaching the input has no effect. All input parameters are cleared when the input is detached, whether explicitly through a call to `mmr_input_detach()` or implicitly when `mmr_input_attach()` is called to attach a new input, which causes `mm-renderer` to detach the current input.



An individual playlist item isn't considered an input but the whole playlist is.

For playlists, any input parameters that you set will apply to the playlist file.

To set parameters for individual playlist items, you must use `mmr_track_parameters()`.

---

The "playlist" and "autolist" input types support the following parameter:

***repeat***

Continuously replay the input. Acceptable values are "none" (default), "track", or "all".

When using the "autolist" or "track" input types with a URL that starts with `audio:`, you can set one of the following two parameters:

***audio\_type***

Classify the audio input based on its content (voice, ring tones, video chat, etc.). This parameter provides a shortcut for setting the audio type, thereby simplifying your client code. You can use this parameter instead of using the Audio Manager API to obtain an audio manager handle, and then using that handle to set the audio type.

The audio type is specified as a string that's set to one of the audio types defined by `AUDIO_TYPE_NAMES`, which is documented in the *Audio Manager Library* reference.

***audioman\_handle***

Associate an audio manager handle with the audio stream that the current context manages. To obtain a value for this parameter, call the `audio_manager_get_handle()` API function and pass in the desired audio type.

You can then use this handle to change the audio type and other audio stream characteristics through the Audio Manager API. For more information, refer to the audio routing functions described in the *Audio Manager Library* reference.

When the input URL starts with `http:` or `https:`, you can set the following parameters that map to `libcurl` options:

- `OPT_VERBOSE`
- `OPT_CONNECTTIMEOUT_MS`
- `OPT_LOW_SPEED_LIMIT`
- `OPT_LOW_SPEED_TIME`
- `OPT_USERAGENT`
- `OPT_USERNAME`
- `OPT_PASSWORD`
- `OPT_PROXYUSERNAME`
- `OPT_PROXYPASSWORD`
- `OPT_COOKIE`
- `OPT_COOKIEFILE`
- `OPT_COOKIEJAR`
- `OPT_COOKIESESSION`
- `OPT_CAINFO`



- `OPT_CAPATH`
- `OPT_SSL_VERIFYPEER`
- `OPT_SSL_VERIFYHOST`
- `OPT_PROXY`
- `OPT_NOPROXY`
- `OPT_HTTPPROXYTUNNEL`
- `OPT_PROXYPORT`
- `OPT_PROXYTYPE`
- `OPT_PROXYAUTH`
- `OPT_HTTPAUTH`
- `OPT_HTTPHEADER`
- `OPT_DNSCACHETIMEOUT`



You can set these same `libcurl` options through the context parameters. For any options defined in both parameter sets, the input parameter settings take precedence.

#### Returns:

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

#### Classification:

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

#### Examples:

See the [mmr\\_output\\_parameters\(\) examples](#) (p. 73) for demos on how to set each of the `audio_type` and `audioman_handle` parameters.

#### `mmr_list_change()`

Set a new playlist.

#### Synopsis:

```
#include <mm/renderer.h>
```

```
int mmr_list_change( mmr_context_t *ctxt,  
                    const char *url,  
                    int delta )
```

**Arguments:*****ctxt***

A context handle.

***url***

The URL of a new playlist.

***delta***

The difference between the position of the current track on the two lists.

**Library:**`mmrndclient`**Description:**

Set a new playlist without interrupting playback. This function can be used only during playback of a playlist (including when it's paused, but not stopped). The new playlist must contain the currently playing track at position  $n+delta$ , where  $n$  is its position on the old playlist. Note that *delta* is a signed value, so it can be negative.

**Returns:**

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

Common errors returned by this function and recommended follow-up actions are:

**MMR\_ERROR\_INVALID\_STATE**

The context was stopped, not playing. The playback might have reached the end of the old playlist and so it was too late to switch playlists without interrupting playback. To fix, attach the new playlist as an input, seek to the beginning of the appropriate track, and start playback.

**MMR\_ERROR\_INVALID\_PARAMETER**

The location in the new list you indicated ( $n + delta$ ) is out of range or refers to a different URL. This error could be caused by a stale *delta* value, which results when the track you thought was playing just ended and a different track is playing now. To fix, recompute the difference between the position of the current track on the two lists.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_output\_attach()****Attach an output.***Synopsis:**

```
#include <mm/renderer.h>

int mmr_output_attach( mmr_context_t *ctxt,
                      const char *url,
                      const char *type )
```

**Arguments:*****ctxt***

A context handle.

***url***

The URL of the new output.

***type***

The output type. Possible values are "audio", "video", and "file" (quotes are required).

**Library:**`mmrndclient`**Description:**

Attach an output to the context and return its output ID (a non-negative integer, unique for this context). An output can be an audio or video device, a combined audio/video device (such as a DSP directly connected to output hardware), or a file. The types of outputs attached to a context may affect the set of operations that the context will allow. For instance, when "playing" to a file (i.e. ripping), seeking or trick play (i.e., playing at non-normal speeds) may not be supported.

Although the API allows requesting multiple outputs of the same type, this may not be supported by all player module implementations. Attaching or detaching outputs while the context has an input may not be supported, either.

Valid URLs for the "audio" output type are in one of the following forms:

- `snd:device`, where *device* is the path of an audio output device, such as `/dev/snd/pcmPreferredp`. This URL format produces behavior similar to the `audio:` format, except that the Audio Manager is bypassed and so you can't provide hints such as the audio type to control audio routing. The advantage of the `snd:` prefix is that you can use it on systems that don't have Audio Manager.
- `audio:name`, where *name* is one of the audio device names defined by the `AUDIO_DEVICE_NAMES` set of string constants, which is listed in the *Audio Manager Library* reference.

The `mm-renderer` service opens the device named in the URL. Client applications should use `audio:default` to specify automated routing for the audio stream unless there's a good reason to use one particular device. When a non-default device is named, the audio stream routing depends solely on that device. For instance, the removal of the device could result in no audio being outputted, or an error returned to the client.



Not all defined audio devices may work with the current application. It is the client's responsibility to determine if a particular device is supported before trying to use it. See the Example section for a demo of how to check if an audio device is supported before configuring the audio routing.

---

Valid output URLs for the "video" output type are of the following form:

```
screen:?wingrp=window_group&
winid=window_id&nodstviewport=1&initflags=invisible
```

In the video URL:

- `window_group` is the window group name of the application's top-level window
- `window_id` is the window ID for the window where the video output will be rendered
- The parameter setting `nodstviewport=1` is optional, and forces `mm-renderer` to never directly modify the destination viewport of the window. This avoids conflicts between simultaneous application manipulation and `mm-renderer` manipulation of the destination viewport.
- The parameter setting `initflags=invisible` is optional, and causes the window to be invisible upon creation. This flag allows you to adjust window properties such as size, position, and z-order before making it visible.

Valid output URLs for the "file" output type are of the form `file:path`, where `path` is the full filepath. The `file:` prefix is optional. The following file types (and their extensions that can go in the URL) are supported:

- Waveform Audio File Format (.wav)
- MPEG 4 Audio (.m4a)
- Adaptive Multi-Rate (.amr)
- 3GPP file format (.3gp)
- Adaptive Multi-Rate Wideband (.awb)
- Qualcomm PureVoice (.qcp)

#### Returns:

A non-negative output ID on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

#### Classification:

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

#### Example:

Suppose you want `mm-renderer` to route the audio output to the "speaker" device. You can do this as follows:

```
#include <mm/renderer.h>
#include <audio/audio_manager_device.h>

// Point the output URL to the default device
char audio_URL[100];
snprintf( audio_URL, 100, "audio:default" );

// Check if the speaker device is supported and
// connected to the system; if so, point the
// output URL to the speaker device
bool supported, connected;

if ( audio_manager_is_device_supported(
        AUDIO_DEVICE_SPEAKER,
        &supported ) == EOK
        && supported )
{
```

```
        if ( audio_manager_is_device_connected(
                AUDIO_DEVICE_SPEAKER,
                &connected ) == EOK
                && connected )
        {
            sprintf( audio_URL, "audio:%s",
                    audio_manager_get_device_name(
                        AUDIO_DEVICE_SPEAKER ) );
        }
    }

    // Attach an audio output, routed to the
    // chosen device
    int outputID;

    if ( outputID = mmr_output_attach( context,
                                        audio_URL, "audio" ) < 0 )
    {
        // Call mmr_error_info() and do error handling
    }
}
```

You can make `mm-renderer` read the input audio from a particular device in a similar way, by substituting the call to `mmr_output_attach()` with a call to `mmr_input_attach()`. The input URL would be of the same form.

### ***mmr\_output\_detach()***

*Detach an output.*

#### **Synopsis:**

```
#include <mm/renderer.h>

int mmr_output_detach( mmr_context_t *ctxt,
                      unsigned output_id )
```

#### **Arguments:**

***ctxt***

A context handle.

***output\_id***

An output ID.

#### **Library:**

`mmrndclient`

**Description:**

Detach the specified output.

**Returns:**

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_output\_parameters()***

*Set output parameters.*

**Synopsis:**

```
#include <mm/renderer.h>
#include <audio/audio_manager_routing.h>

int mmr_output_parameters( mmr_context_t *ctxt,
                          unsigned output_id,
                          strm_dict_t *parms )
```

**Arguments:*****ctxt***

A context handle.

***output\_id***

An output ID.

***parms***

A dictionary containing the output parameters to set (must not be NULL). Any previous parameters are overridden.

The `strm_dict_t` object becomes API property after this call, even if the call fails. You should not use or destroy the dictionary after passing it to this function.

**Library:**

`mrrndclient`, `audio_manager_lib`

**Description:**

Set parameters for an output device. The acceptable parameter values depend on the plugins loaded for the attached output and the attached input, if any. Unlike input and track parameters, the values of output parameters won't be changed by `mm-renderer` plugins. If the provided values aren't supported for the current output and input combination, the function call fails.

The output type determines which output parameters you can set. At present, there are no output parameters for the "file" output type.

For the "audio" output type, the following parameter is available for any URL format:

**volume**

Set the volume for this audio stream. The volume must be in the range of 0 to 100.

When using the "audio" output type with a URL that starts with `audio:`, you can set one of the following two parameters:

***audio\_type***

Classify the audio track based on its content (voice, ring tones, video chat, etc.). This parameter provides a shortcut for setting the audio type, thereby simplifying your client code. You can use this parameter instead of using the Audio Manager API to obtain an audio manager handle, and then using that handle to set the audio type.

The audio type is specified as a string that's set to one of the audio types defined by `AUDIO_TYPE_NAMES`, which is documented in the *Audio Manager Library* reference.

***audioman\_handle***

Associate an audio manager handle with the audio stream that the current context manages. To obtain a value for this parameter, call the `audio_manager_get_handle()` API function and pass in the desired audio type.

You can then use this handle to change the audio type and other audio stream characteristics through the Audio Manager API. For more information, refer to the audio routing functions described in the *Audio Manager Library* reference.



For the "video" output type, your application should modify the output window directly by using the `libscreen` library, as demonstrated in "[Managing video windows](#) (p. 29)".



The legacy video output parameters `video_dest_*`, `video_src_*`, and `video_clip_*` have been deprecated. Using `libscreen` is the proper way to configure video output.

The `mmr_output_attach()` function sets the parameters `url` and `type`. Some plugins allow you to modify the URL with `mmr_output_parameters()`. For instance, you can ask `mm-renderer` to switch output devices by calling `mmr_output_parameters()` with a new URL in the parameters.

#### Returns:

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

#### Classification:

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

#### Examples:

Suppose you want to set the `audio_type` parameter to indicate that an output audio stream contains dialing and call progress tones, also referred to as *voice tones*. You must look up the audio type string by passing the `AUDIO_TYPES_VOICE_TONES` code to the Audio Manager API, store the returned string in a dictionary, and pass the dictionary to `mm-renderer`, as follows:

```
#include <mm/renderer.h>
#include <strm.h>

strm_dict_t* dict = strm_dict_new();

if ( dict = strm_dict_set( dict, "audio_type",
                          audio_manager_get_name_from_type(
                            AUDIO_TYPE_VOICE_TONES ) ) == NULL )
{
    // Do error handling
}
```

```
if ( mmr_output_parameters( context,
                           output_id, dict ) < 0 )
{
    // Call mmr_error_info() and do error handling
}
```

Presently, the audio type is the only audio stream characteristic that clients can set directly through `mm-renderer`. The Audio Manager API lets clients manage additional characteristics of an audio stream. For example, you could set both the audio type and reset conditions, as follows:

```
#include <mm/renderer.h>
#include <strm.h>
#include <audio/audio_manager_routing.h>

unsigned int audio_hndl;

if ( audio_manager_get_handle(
    AUDIO_TYPE_VOICE_TONES, 0,
    false, &audio_hndl ) != EOK )
{
    // Check errno, do error handling, and exit
}

if ( audio_manager_set_handle_routing_conditions(
    audio_hndl,
    SETTINGS_RESET_ON_DEVICE_CONNECTION ) != EOK )
{
    // Check errno, do error handling, and exit
}

// Store the handle in the dictionary before
// setting the output parameters
...
```

You can set the `audio_type` or `audioman_handle` parameters for an input in a similar way, by substituting the call to `mmr_output_parameters()` with a call to `mmr_input_parameters()`.

## ***mmr\_play()***

*Start playing.*

### **Synopsis:**

```
#include <mm/renderer.h>

int mmr_play( mmr_context_t *ctxt )
```

**Arguments:***ctxt*

A context handle.

**Library:**`mmrndclient`**Description:**

Start playing. A no-op if already playing.

Once `mm-renderer` is playing media, you can adjust the play speed, seek to another position, change playlists, or stop playback.**Returns:**Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_seek()****Seek to a position.***Synopsis:**

```
#include <mm/renderer.h>

int mmr_seek( mmr_context_t *ctxt,
              const char *position )
```

**Arguments:***ctxt*

A context handle.

*position*

The position to seek to, in a media-specific format.

**Library:**

`mmrndclient`

**Description:**

Seek to a known position in a single track or a track within a playlist. The required format of the position string depends on the type of the attached input.

For the "track" type, the position is simply the number of milliseconds from the start of the track (e.g., "2500"). We refer to this time measurement as the *track offset*.

For the "playlist" and "autolist" types, the position must be specified as two numbers separated by a colon (e.g., "2:1200"), where the first number is the track index within the playlist and the second number is the track offset. For an "autolist" input, in which a single track is formatted as a playlist, the first number must be 1.

**Returns:**

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_speed\_set()***

*Set the play speed, in units of 1/1000 of normal speed.*

**Synopsis:**

```
#include <mm/renderer.h>

int mmr_speed_set( mmr_context_t *ctxt,
                  int speed )
```

**Arguments:**

*ctxt*

A context handle.

*speed*

The new speed.

**Library:**

`mmrncclient`

**Description:**

Set the play speed, in units of 1/1000 of normal speed. If the context is playing (including if it's paused), the new speed is applied immediately; otherwise, it's stored in the context and applied the next time [`mmr\_play\(\)`](#) (p. 74) is called.

Use a speed of zero (0) to pause playback. Depending on the input media, *trick play*, which entails playing at speeds other than normal speed (1000), may be unsupported or forbidden, either completely or only for some portions of the media. Examples of this include:

- A playlist may contain tracks that don't support trick play
- Some devices have only one fast-forward speed
- DVDs forbid pausing or fast-forwarding through menus and some portions of titles

If an `mmr_speed_set()` call requests a speed for trick play but the exact value is completely unsupported by the current input, the speed may be rounded to a supported value in the same category (e.g., negative, slow, or fast). If the entire category is unsupported, the call fails.

If the call was made during playback, and the speed (after the rounding described above) is unsupported or forbidden at the current playing position, the speed is changed to an allowed value and the call succeeds. A similar speed change may occur in the `mmr_play()` call, based on the current speed and position, and during playback if a position is reached (by playing or by an explicit seek request) where the current play speed is unsupported or forbidden. The navigation rules for the input media may also specify other circumstances that cause the speed to change to normal during playback. In particular, you can configure whether the speed reverts to normal when track boundaries are reached during playback.

**Returns:**

Zero on success, -1 on failure (use [`mmr\_error\_info\(\)`](#) (p. 57)).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***mmr\_stop()***

*Stop playing.*

**Synopsis:**

```
#include <mm/renderer.h>
int mmr_stop( mmr_context_t *ctxt )
```

**Arguments:**

***ctxt***

A context handle.

**Library:**

`mmrndclient`

**Description:**

Stop playing. A no-op if already stopped. Depending on the input media, stopping the playback may cause the playing position to change or even become indeterminate. Unless you know the behavior of the media being played, use the function [mmr\\_seek\(\)](#) (p. 75) to seek to a known position before restarting the playback.

When playback is explicitly stopped using *mmr\_stop()*, `mm-renderer` doesn't publish an error code. When the end of media is reached, the error code is set to `MMR_ERROR_NONE`.

**Returns:**

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No

Safety:	
Signal handler	No
Thread	Yes

***mmr\_track\_parameters()***

*Set track parameters.*

**Synopsis:**

```
#include <mm/renderer.h>

int mmr_track_parameters( mmr_context_t *ctxt,
                        unsigned index,
                        strm_dict_t *parms )
```

**Arguments:*****ctxt***

A context handle.

***index***

Zero to set the default parameters, or a nonzero index within the current playlist window.

***parms***

A dictionary containing the track parameters to set. Use NULL to reset the parameters of the specified track to the default values assigned to track 0. Any previous parameters are overridden.

The `strm_dict_t` object becomes API property after this call, even if the call fails. You should not use or destroy the dictionary after passing it to this function.

**Library:**

`mmrndclient`

**Description:**

Set track parameters. This function can be used when the input type is "playlist" or "autolist". When the input type is "track", this function has no effect.

For "playlist" inputs, *index* specifies the track that these parameters are applied to. The provided index must be within range of the current playlist window or the

function call will fail. An index of zero specifies the default parameters given to a new track when it enters the playlist window.

For "autolist" inputs, any input parameters that you set before attaching the input are taken as the initial track parameters (because the single track is the input). If you want to change them after attaching the input, use *mmr\_track\_parameters()*. Changes to input parameters other than *repeat* are ignored.

Some `mm-renderer` plugins don't return errors when you provide unacceptable values for track parameters. Instead, these plugins revert bad parameters to their previous values or to their default values (for parameters that you set for the first time). To see which values were accepted or changed, client applications can examine the parameters that the Event API returned.

When the input URL starts with `audio:`, you can set one of the following two parameters:

#### ***audio\_type***

Classify the audio track based on its content (voice, ring tones, video chat, etc.). This parameter provides a shortcut for setting the audio type, thereby simplifying your client code. You can use this parameter instead of using the Audio Manager API to obtain an audio manager handle, and then using that handle to set the audio type.

The audio type is specified as a string that's set to one of the audio types defined by `AUDIO_TYPE_NAMES`, which is documented in the *Audio Manager Library* reference.

#### ***audioman\_handle***

Associate an audio manager handle with the audio stream that the current context manages. To obtain a value for this parameter, call the *audio\_manager\_get\_handle()* API function and pass in the desired audio type.

You can then use this handle to change the audio type and other audio stream characteristics through the Audio Manager API. For more information, refer to the audio routing functions described in the *Audio Manager Library* reference.

When the input URL starts with `http:` or `https:`, you can set the following parameters that map to `libcurl` options:

- `OPT_VERBOSE`
- `OPT_CONNECTTIMEOUT_MS`
- `OPT_LOW_SPEED_LIMIT`
- `OPT_LOW_SPEED_TIME`



- `OPT_USERAGENT`
- `OPT_USERNAME`
- `OPT_PASSWORD`
- `OPT_PROXYUSERNAME`
- `OPT_PROXYPASSWORD`
- `OPT_COOKIE`
- `OPT_COOKIEFILE`
- `OPT_COOKIEJAR`
- `OPT_COOKIESESSION`
- `OPT_CAINFO`
- `OPT_CAPATH`
- `OPT_SSL_VERIFYPEER`
- `OPT_SSL_VERIFYHOST`
- `OPT_PROXY`
- `OPT_NOPROXY`
- `OPT_HTTPPROXYTUNNEL`
- `OPT_PROXYPORT`
- `OPT_PROXYTYPE`
- `OPT_PROXYAUTH`
- `OPT_HTTPAUTH`
- `OPT_HTTPHEADER`
- `OPT_DNSCACHETIMEOUT`



You can set these same `libcurl` options through the context or input parameters. For any options defined in either the context or input parameters but also in the track parameters, the track parameter settings take precedence.

#### Returns:

Zero on success, -1 on failure (use [mmr\\_error\\_info\(\)](#) (p. 57)).

#### Classification:

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

**Examples:**

See the [mmr\\_output\\_parameters\(\) examples](#) (p. 73) for demos on how to set each of the *audio\_type* and *audioman\_handle* parameters.

# Chapter 4

## Multimedia Renderer Event API

---

The multimedia renderer Event API exposes the data types that contain event information and the functions that let you monitor and process events.

The Event API provides functions for waiting on events and for retrieving information on the latest event that occurred. The event information delivered by the API includes, but is not limited to:

- the event type
- the context state
- a warning string, when applicable
- detailed error information, when applicable

Using this API, you can process events in an automated way without having to access and parse status files to keep up with the state of the `mm-renderer` service. You can instead write an event-processing loop to continuously monitor and react to events by storing the necessary data and performing follow-up actions.

The header file for the Event API, `events.h`, is located in `/qnxcar2/target/usr/include/mm/renderer/` on the development system (not the target).

## Data types in events.h

---

Event data types in the `mmrndclient` library.

### *mmr\_event\_t*

The mm-renderer event information.

#### Synopsis:

```
#include <mm/renderer/events.h>

typedef struct mmr_event {
    mmr_event_type_t type;
    mmr_state_t state;
    int speed;
    union mmr_event::mmr_event_details details;
    const strm_string_t *pos_obj;
    const char *pos_str;
    const strm_dict_t *data;
    const char *objname;
    void *usrdata;
} mmr_event_t;
```

#### Data:

##### *type*

The event type.

##### *state*

The new context state (valid even when type is `MMR_EVENT_NONE`).

##### *speed*

The playback speed (0 means paused).

##### *details*

The event details (varies by type).

##### *pos\_obj*

The playback position when the event occurred, stored as a shareable string, for `STATUS`, `ERROR`, and `WARNING` events; otherwise `NULL`.

##### *pos\_str*

The playback position when the event occurred, stored as a string, for `STATUS`, `ERROR`, and `WARNING` events; otherwise `NULL`.

The position is expressed in the same media-specific format used by the [\*mmr\\_seek\(\)\*](#) (p. 75) function (for single tracks, it's `milliseconds`; for playlists, it's `tracknumber:milliseconds`; for autolists, it's `1:milliseconds`).

***data***

The full set of `mm-renderer` properties reported by the event, stored in a dictionary object. When this field is NULL, the set of properties no longer exists; for example, the input parameters, URL, and type are deleted when the input is detached.

***objname***

The name of the internal `mm-renderer` object associated with this event.

***usrdata***

The user data associated with the dictionary; NULL if there's no user data.

**Library:**

`mmrndclient`

**Description:**

The `mmr_event_t` structure is returned by [\*mmr\\_event\\_get\(\)\*](#) (p. 96) and provides information on the last event. For all events, the structure contains the event type, the latest context state and playback speed, and if applicable, the playback position when the event occurred. For certain event types, there is additional information contained in the `mmr_event::details` and/or `mmr_event::data` fields.

**Classification:**

QNX Neutrino

***mmr\_event::details***

*The mm-renderer event information.*

**Synopsis:**

```
#include <mm/renderer/events.h>

union mmr_event::mmr_event_details {
    struct mmr_event_state {
        mmr_state_t oldstate;
        int oldspeed;
    } state;
    struct mmr_event_error {
```

```
        mmr_error_info_t info;
    } error;

    struct mmr_event_warning {
        const char *str;
        const strm_string_t *obj;
    } warning;

    struct mmr_event_metadata {
        unsigned index;
    } metadata;

    struct mmr_event_trkparam {
        unsigned index;
    } trkparam;

    struct mmr_event_playlist {
        unsigned start;
        unsigned end;
        unsigned length;
    } playlist;

    struct mmr_event_output {
        unsigned id;
    } output;
} details;
```

**Data:*****state***

Used when `mmr_event.type` is `MMR_EVENT_STATE`.

The `mmr_event_state` structure has these members:

**`mmr_state_t` *oldstate***

The state before the event.

**`int` *oldspeed***

The speed before the event.

***error***

Used when `mmr_event.type` is `MMR_EVENT_ERROR`.

The `mmr_event_error` structure has these members:

**`mmr_error_info_t` *info***

The error information.

***warning***

Used when `mmr_event.type` is `MMR_EVENT_WARNING`.

The `mmr_event_warning` structure has these members:

**`const char* str`**

The warning string, as a C string.

**`const strm_string_t* obj`**

The warning string, as a `strm_string_t` (dictionary string).

### ***metadata***

Used when `mmr_event.type` is `MMR_EVENT_METADATA`.

The `mmr_event_metadata` structure has these members:

**`unsigned index`**

The playlist index for playlist-related events; otherwise, zero.

### ***trkparam***

Used when `mmr_event.type` is `MMR_EVENT_TRKPAR`.

The `mmr_event_trkparam` structure has these members:

**`unsigned index`**

The playlist index.

### ***playlist***

Used when `mmr_event.type` is `MMR_EVENT_PLAYLIST`.

The `mmr_event_playlist` structure has these members:

**`unsigned start`**

The index of the first item in the playlist window.

**`unsigned end`**

The index of the last item in the playlist window.

**`unsigned length`**

The playlist length.

### ***output***

Used when `mmr_event.type` is `MMR_EVENT_OUTPUT`.

The `mmr_event_output` structure has these members:

**unsigned *id***

The output ID.

**Library:**

`mmrndclient`

**Description:**

The event details structure.

**Classification:**

QNX Neutrino

***mmr\_event::data***

*The mm-renderer properties reported by the event.*

**Description:**

All the `mm-renderer` properties reported by the event, represented as a dictionary object stored in the `data` field of the `mmr_event_t` data structure. Some events, such as `STATE`, `ERROR`, and `WARNING` events, have all their properties pre-parsed into other `mmr_event_t` fields, so no additional information can be found in the `data` field. Other events, notably events that indicate updates to `mm-renderer` parameters or metadata, have most of their properties stored in the `data` field, so clients must extract this information from the dictionary.

Which properties are stored in the dictionary depends also on the configuration of the attached input and outputs. For instance, the properties returned with events that indicate updates to input, track, or output parameters consist of the latest parameters the client passed into the Client API, plus the track URL and type. The properties returned with `METADATA` events vary with the input properties (e.g., the file format, and whether the input is a track or playlist).

To look up parameter values in a `strm_dict_t` dictionary object by name, see the [`strm\_dict\_find\_value\(\)`](#) (p. 107) function in the Dictionary Object API.

The event types with information stored in the `data` field, and the associated dictionary contents are as follows:



Event type	Property name	Description
MMR_EVENT_STATUS	<i>position</i>	Playback position. This is the same value stored in the <i>pos_str</i> (p. 84) field in the <i>mmr_event_t</i> structure.
	<i>bufferstatus</i>	Status or current activity of the buffer: <i>buffering</i> , <i>playing</i> , or <i>idle</i>
	<i>bufferlevel</i>	Buffer usage level, represented by two decimal numbers (in milliseconds) separated by a slash: <i>level/capacity</i>
	<i>volume</i>	Available only for audio recording. The current volume level of the input signal against the maximum volume level, separated by a slash: <i>current_level/maximum_level</i>
MMR_EVENT_METADATA	<i>md_title_name</i>	Track name
	<i>md_title_artist</i>	Artist name
	<i>md_title_album</i>	Album name
	<i>md_title_genre</i>	Genre (classical, rock, funk, etc.)
	<i>md_title_comment</i>	Text information about the track. The source of this information depends on the track format. For example, the information is taken from the COMM frame for ID3 tracks.
	<i>md_title_duration</i>	Track length
	<i>md_title_track</i>	Track number (if track was ripped from CD)
	<i>md_title_disc</i>	Disc number (if track was ripped from multi-disc album)
	<i>md_title_samplerate</i>	Number of samples taken from input signal per time unit (typically, a second) during recording. For audio content, this field refers to the audio sampling rate; for video, it's the video frame rate.
	<i>md_title_bitrate</i>	Track bit rate. This is only an approximate value, based on the total bit rate from all media streams in the input track and ignoring any potential variation in bit rate throughout playback.
	<i>md_title_protected</i>	Boolean attribute (either 0 or 1) indicating if track is DRM-protected
	<i>md_title_seekable</i>	Boolean attribute (either 0 or 1) indicating if track supports seeking
<i>md_title_pausable</i>	Boolean attribute (either 0 or 1) indicating if track can be paused	

Event type	Property name	Description
	<i>md_title_mediatype</i>	Track media type (2 for video only, 4 for audio only, and 6 for audio and video)
	<i>md_video_width</i>	Video width, in physical units
	<i>md_video_height</i>	Video height, in physical units
	<i>md_video_pixel_width</i>	Video width, in pixels
	<i>md_video_pixel_height</i>	Video height, in pixels
	<i>md_video_capture_format</i>	Media file format in which video was recorded
MMR_EVENT_PLAYLIST	All playlist information fields	Playlist information fields contained in the <a href="#">mmr_event_playlist</a> (p. 85) structure, which is stored in the <i>details</i> field of the <code>mmr_event</code> structure for playlist events.
MMR_EVENT_INPUT	All input parameters and the input URL and type	Input parameters specified in the last call to <a href="#">mmr_input_parameters()</a> (p. 62), and the input URL and type specified in the last call to <a href="#">mmr_input_attach()</a> (p. 58). Some input parameters may have been changed by <code>mm-renderer</code> .
MMR_EVENT_OUTPUT	All output parameters and the output URL and type	Output parameters specified in the last call to <a href="#">mmr_output_parameters()</a> (p. 71), the output type specified in the last call to <a href="#">mmr_output_attach()</a> (p. 67), and the output URL specified in the last call to either of these two functions.
MMR_EVENT_CTXTPAR	All context parameters	Context parameters specified in the last call to <a href="#">mmr_context_parameters()</a> (p. 54).
MMR_EVENT_TRKPAR	All track parameters	Track parameters specified in the last call to <a href="#">mmr_track_parameters()</a> (p. 79).

### ***mmr\_event\_type\_t***

*The mm-renderer API events.*

#### **Synopsis:**

```
#include <mm/renderer/events.h>

typedef enum mmr_event_type {
    MMR_EVENT_NONE,
    MMR_EVENT_ERROR,
    MMR_EVENT_STATE,
    MMR_EVENT_OVERFLOW,
    MMR_EVENT_WARNING,
```

```
MMR_EVENT_STATUS,  
MMR_EVENT_METADATA,  
MMR_EVENT_PLAYLIST,  
MMR_EVENT_INPUT,  
MMR_EVENT_OUTPUT,  
MMR_EVENT_CTXTPAR,  
MMR_EVENT_TRKPAR,  
MMR_EVENT_OTHER,  
} mmr_event_type_t;
```

**Data:****MMR\_EVENT\_NONE**

No pending events.

**MMR\_EVENT\_ERROR**

Playback has stopped due to an error or EOF.

**MMR\_EVENT\_STATE**

State or speed change, other than an error or EOF.

**MMR\_EVENT\_OVERFLOW**

Some state changes lost; the event contains the most recent state.

**MMR\_EVENT\_WARNING**

Warning event.

**MMR\_EVENT\_STATUS**

Status update (position, buffer level, etc).

**MMR\_EVENT\_METADATA**

Metadata update for the attached input, or one track referenced by the attached input (such as a playlist entry).

**MMR\_EVENT\_PLAYLIST**

Playlist window update.

**MMR\_EVENT\_INPUT**

An input has been attached or detached, or input parameters have changed.

**MMR\_EVENT\_OUTPUT**

An output has been attached or detached, or output parameters have changed.

**MMR\_EVENT\_CTXTPAR**

Context parameters have changed.

**MMR\_EVENT\_TRKPAR**

Track parameters for an individual track or a playlist entry have changed.

**MMR\_EVENT\_OTHER**

None of the above, but something has changed. You can typically ignore this event type.

**Library:**

`mmrndclient`

**Description:**

The enumerated type `mmr_event_type_t` defines all possible events that can be observed through the Event API. Events include: changes to the context state or playback speed; updates of metadata or the playlist window; and attachment and detachment of input and output devices.

To obtain the type of the last event, call `mmr_event_get()` and examine the `type` field in the `mmr_event_t` structure returned by the function.

**Classification:**

QNX Neutrino

***mmr\_state\_t***

*The context states.*

**Synopsis:**

```
#include <mm/renderer/events.h>

typedef enum mmr_state {
    MMR_STATE_DESTROYED,
    MMR_STATE_IDLE,
    MMR_STATE_STOPPED,
    MMR_STATE_PLAYING,
} mmr_state_t;
```

**Data:**

**MMR\_STATE\_DESTROYED**

The context has been destroyed.

**MMR\_STATE\_IDLE**

The context has no input.

**MMR\_STATE\_STOPPED**

The context has an input but is not playing.

**MMR\_STATE\_PLAYING**

The context is playing or paused.

**Library:**

`mmrndclient`

**Description:**

The enumerated type `mmr_state_t` defines the context states, which are based on the current input and playback activity.

To obtain the context state following the latest API event, call `mmr_event_get()` and examine the `state` field in the `mmr_event_t` structure returned by the function.

**Classification:**

QNX Neutrino

## Functions in events.h

---

Event functions in the `mmrndclient` library.

### *mmr\_event\_arm()*

Set a `sigevent` to deliver when a new event becomes available.

#### Synopsis:

```
#include <mm/renderer/events.h>

int mmr_event_arm( mmr_context_t *ctxt,
                  struct sigevent const *sev )
```

#### Arguments:

***ctxt***

A context handle.

***sev***

A `sigevent` to send; set to `NULL` to disarm.

#### Library:

`mmrndclient`

#### Description:

Set a `sigevent` to deliver when a new `mm-renderer` event becomes available. The `mmr_event_arm()` function is helpful if your program already has an event-processing loop that uses signals or pulses as notifications and you simply want to add code that processes `mm-renderer` events. To do this, you must first call `mmr_event_arm()` to request notification of the next `mm-renderer` event. Then, in the new event-handling code, you must call `mmr_event_get()` (p. 96) to retrieve the event information.

Because `mmr_event_arm()` enables notification of only one event, you must call `mmr_event_arm()` repeatedly if you want to receive a `sigevent` for each `mm-renderer` event that occurs. The function is non-blocking because although it enables notification of an event, it doesn't wait for the event to occur.

If `mm-renderer` already has an event waiting when you call `mmr_event_arm()`, the function doesn't arm a `sigevent` but immediately returns a value greater than zero. If you receive such a value, you must call `mmr_event_get()` and process the event.

Occasionally, the `mmr_event_get()` function can't retrieve any meaningful event data and instead returns the `MMR_EVENT_NONE` event. This can happen if the `sigevent` wasn't armed (because an event was already waiting) or if the `sigevent` was armed and then delivered by the system (because an event occurred after the last `mmr_event_arm()` call). For an example of a situation when `MMR_EVENT_NONE` might be returned, see [mmr\\_event\\_wait\(\)](#) (p. 97).

**Returns:**

A positive number if the `sigevent` isn't armed, zero on success, or -1 on failure (check `errno`).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	<b>No</b> , except when using different context handles

***mmr\_event\_data\_set()***

*Set user data for the dictionary returned with the last event.*

**Synopsis:**

```
#include <mm/renderer/events.h>

int mmr_event_data_set( mmr_context_t *ctxt, void *usrdata )
```

**Arguments:**

***ctxt***

A context handle.

***usrdata***

A pointer to the user data to associate with the dictionary.

**Library:**

`mmrndclient`

**Description:**

Set a pointer to the user data to associate with the dictionary returned with the last event. The dictionary is stored in the `mmr_event_t` structure's `data` field and contains all the `mm-renderer` properties reported by the event.

Some event types, including STATE, ERROR, and WARNING, share a single dictionary and therefore have a common user data pointer. So, if you set the user data after receiving, say, a STATE event, the same user data pointer is returned with any subsequent STATE, ERROR, or WARNING event. Other event types, including METADATA, OUTPUT, and TRKPAR, each have multiple dictionaries, distinguished by an index stored in the `mmr_event_t details` field. So, if you set the user data after receiving say, a METADATA event with an index of 2, the same user data is returned only for other METADATA events whose index is also 2.

**Returns:**

Zero on success, or -1 if the event was `MMR_EVENT_NONE` or a deletion.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	<b>No</b> , except when using different context handles

***mmr\_event\_get()***

*Get the next available event.*

**Synopsis:**

```
#include <mm/renderer/events.h>

const mmr_event_t* mmr_event_get( mmr_context_t *ctxt )
```

**Arguments:**

***ctxt***

A context handle.



**Library:**`mmrndclient`**Description:**

Get the next available event. The function returns an `mmr_event_t` structure, which contains detailed event information such as the new context state (see [mmr\\_event\\_t](#) (p. 84) for details). Typically, you would call this function within an event-processing loop, after calling either [mmr\\_event\\_arm\(\)](#) (p. 94) or [mmr\\_event\\_wait\(\)](#) (p. 97).

The data returned in the `mmr_event_t` structure is valid only until the next [mmr\\_event\\_get\(\)](#) call. If you want to keep the data longer, copy the `mmr_event_t` contents into other program variables, cloning any `strm_string_t` fields within the structure.



In any playback state, [mmr\\_event\\_get\(\)](#) might return the `MMR_EVENT_NONE` event. Applications must gracefully handle this event, perhaps simply by ignoring it. For an example of a situation when `MMR_EVENT_NONE` might be returned, see [mmr\\_event\\_wait\(\)](#) (p. 97).

**Returns:**

A pointer to an event, or NULL on failure (check *errno*).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	<b>No</b> , except when using different context handles

***mmr\_event\_wait()***

*Wait until an event is available.*

**Synopsis:**

```
#include <mm/renderer/events.h>

int mmr_event_wait( mmr_context_t *ctxt )
```

**Arguments:**

*ctx*

A context handle.

**Library:**

`mmrndclient`

**Description:**

Wait for an event. This function usually blocks until an event occurs, at which point it unblocks and you can call [mmr\\_event\\_get\(\)](#) (p. 96) to get the event details.

Occasionally, `mmr_event_wait()` may unblock or not block at all even though no events are available. For example, suppose a track enters the playlist range but then exits soon afterwards. The `mm-renderer` service creates metadata for the track when it comes in range and this activity generates an event. If the track exits the playlist range before the application calls `mmr_event_get()`, the track's metadata and the corresponding event are deleted. In the subsequent call to `mmr_event_get()`, the function will return the `MMR_EVENT_NONE` event.

Typically, you call `mmr_event_wait()` within an event-processing loop, right before you call `mmr_event_get()`.

**Returns:**

Zero on success, or -1 on failure (check *errno*).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	<b>No</b> , except when using different context handles

# Chapter 5

## Dictionary Object API

---

A dictionary object is a collection of key-value pairs that maps the names of parameters to their values. For `mm-renderer`, you can use the dictionary API to define context, input, and output parameters. Other components can use the same API to manage parameters specific to their purpose.

Both the keys and values are represented by shareable string objects. A shareable string is a data structure that encapsulates a string so that it can't be modified directly. This design allows multiple processes to read the string without the risk that the string will be changed inadvertently between reads. Modifying a shareable string actually destroys it and creates a new one.

The dictionary object API allows you to create multiple handles to a dictionary object and then use and even delete these handles in independent program components. After it's created, a dictionary is immutable until destroyed, so separate components can access it through their handles without worrying about synchronization.

Different dictionary object handles may be represented by identical pointers, so you shouldn't compare handles. Regardless of how the handles are represented internally, you must destroy each handle separately to properly dispose of any resources associated with it.

## Data types in strm.h

---

Data types in the `libstrm` library.

### `strm_dict_t`

*The dictionary object type*

#### Synopsis:

```
#include <strm.h>

typedef struct strm_dict strm_dict_t;
```

#### Description:

The structure `strm_dict_t` is a private data type representing a dictionary object.

Dictionaries cannot be modified; they can only be created and destroyed. For example, the function `strm_dict_set()` takes a dictionary object handle, destroys it, creates a replica of the dictionary object and returns a new handle to it. It's equivalent to calling `strm_string_destroy()` and `strm_string_make()`, except that it may reuse the original object's memory.

Different dictionary object handles may be represented by identical pointers. You should not compare handles. Regardless of how the handles are represented internally, you have to call `strm_dict_destroy()` separately for each handle to properly dispose of any resources associated with it.

Use the following functions to manipulate dictionary objects:

- `strm_dict_clone()`
- `strm_dict_compare()`
- `strm_dict_destroy()`
- `strm_dict_find_index()`
- `strm_dict_find_rstr()`
- `strm_dict_find_value()`
- `strm_dict_index_delete()`
- `strm_dict_key_delete()`
- `strm_dict_key_get()`
- `strm_dict_key_rstr()`
- `strm_dict_new()`
- `strm_dict_set()`
- `strm_dict_set_rstr()`

- *strm\_dict\_size()*
- *strm\_dict\_subtract()*
- *strm\_dict\_value\_get()*
- *strm\_dict\_value\_rstr()*

**Class:**

QNX Neutrino

**strm\_string\_t***Shareable string type***Synopsis:**

```
#include <strm.h>
typedef struct strm_string strm_string_t;
```

**Description:**

The structure `strm_string_t` is a private data type representing a shareable string.

Shareable strings cannot be modified; they can only be created and destroyed. For example, the function *strm\_string\_modify()* takes a shareable string object handle, destroys the object, creates a new shareable string object and returns a new handle to it. It is equivalent to calling *strm\_string\_destroy()* and *strm\_string\_make()*, except that it may reuse the original object's memory.

Different shareable string object handles may be represented by identical pointers. You should not compare handles. Regardless of how the handles are represented internally, you have to call *strm\_string\_destroy()* separately for each handle to properly dispose of any resources associated with it.

Use the following functions to manipulate shareable strings:

- *strm\_string\_alloc()*
- *strm\_string\_clone()*
- *strm\_string\_destroy()*
- *strm\_string\_get()*
- *strm\_string\_make()*
- *strm\_string\_modify()*

**Class:**

QNX Neutrino

## Functions in strm.h

---

Functions in the `libstrm` library.

### *strm\_dict\_clone()*

*Duplicate a dictionary handle*

#### Synopsis:

```
#include <strm.h>

strm_dict_t *strm_dict_clone( const strm_dict_t *dict );
```

#### Arguments:

*dict*

A dictionary object handle.

#### Library:

`libstrm`

#### Description:

The function *strm\_dict\_clone()* creates a new handle to the dictionary object referenced by the specified handle.

Note that multiple handles may be represented by identical pointer values; you should not compare handles.

#### Returns:

A new dictionary object handle to the dictionary object referenced by the specified handle.

#### Classification:

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_compare()****Compare two dictionaries***Synopsis:**

```
#include <strm.h>

strm_dict_t *strm_dict_compare( strm_dict_t *newdict,
                               strm_dict_t const *olddict );
```

**Arguments:*****newdict***

A handle to the newer version of a dictionary object.

***olddict***

A handle to the older version of a dictionary object.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_compare()* compares two dictionaries. It creates a replica of *newdict* and removes all those entries that also exist in *olddict* and have the same value. In other words, if *olddict* is the older version of some dictionary and *newdict* is the newer version, the resulting dictionary contains the entries that were changed or added, but not the ones that were left alone or deleted. If the same handle is passed for both arguments, this function returns an empty dictionary object.

Note that the *newdict* handle is closed and becomes invalid after calling this function, even on a failure, but the *olddict* handle is not (unless it's the same handle).

**Returns:**

A dictionary handle to the dictionary object containing the result of the comparison, or a null pointer on failure.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No

Safety:	
Signal handler	No
Thread	Yes

***strm\_dict\_destroy()***

*Destroy a dictionary object handle*

**Synopsis:**

```
#include <strm.h>
int strm_dict_destroy( strm_dict_t *dict );
```

**Arguments:**

***dict***

A dictionary object handle.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_destroy()* destroys the specified dictionary object handle and frees the memory allocated for the dictionary object if this is the last handle.

**Returns:**

0

Success.

-1

An error occurred (*errno* is set).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No



Safety:	
Thread	Yes

***strm\_dict\_find\_index()***

*Return the index of a dictionary entry*

**Synopsis:**

```
#include <strm.h>

ssize_t strm_dict_find_index( const strm_dict_t *dict,
                             const char *key );
```

**Arguments:**

***dict***

A dictionary object handle.

***key***

The key of an entry to look up.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_find\_index()* returns the index of the entry specified by the *key* argument, if found in the specified dictionary.

**Returns:**

The index of the specified entry on success, or -1 if the entry is not found.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_find\_rstr()***

Find the value of a dictionary entry based on the entry's key (returns a shareable string object handle)

**Synopsis:**

```
#include <strm.h>

const strm_string_t *strm_dict_find_rstr(
    const strm_dict_t *dict,
    const char *key );
```

**Arguments:*****dict***

A handle to a dictionary object.

***key***

The name of the dictionary entry.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_find\_rstr()* finds the dictionary entry specified by the *key* argument, returning a handle to the entry's value. The returned shareable string object handle is owned by the dictionary, and remains valid until the dictionary handle is destroyed.

**Returns:**

A handle to the value of the dictionary entry specified by the *key* parameter if the the entry is found, or a null pointer if it isn't found.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_find\_value()***

*Find the value of a dictionary entry based on the entry's key (returns a string)*

**Synopsis:**

```
#include <strm.h>

const char *strm_dict_find_value( const strm_dict_t *dict,
                                 const char *key );
```

**Arguments:*****dict***

A dictionary object handle.

***key***

The key of the dictionary entry.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_find\_value()* returns the value of the dictionary entry specified by the *key* argument. The returned string is owned by the dictionary, and remains valid until the dictionary handle is destroyed.

**Returns:**

The value (as a string) of the dictionary entry specified by the *key* parameter if the entry is found, or a null pointer if it isn't found.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_index\_delete()***

*Delete a dictionary entry (by index)*

**Synopsis:**

```
#include <strm.h>

strm_dict_t *strm_dict_index_delete( strm_dict_t *dict,
                                     size_t index );
```

**Arguments:*****dict***

A dictionary object handle.

***index***

The index of the entry to delete.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_index\_delete()* creates a new dictionary object that is an exact replica of the old object, except the entry specified by the *index* argument is deleted. The function returns a handle for the new dictionary object, or a null pointer on failure (including when the index is out of range). On success, the original dictionary handle is destroyed.

**Returns:**

A handle for the new dictionary object, or a null pointer on failure (including when the index is out of range).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_key\_delete()****Delete a dictionary entry (by key)***Synopsis:**

```
#include <strm.h>

strm_dict_t *strm_dict_key_delete( strm_dict_t *dict,
                                   char const *key );
```

**Arguments:*****dict***

A dictionary object handle.

***key***

The key of the entry to delete.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_key\_delete()* creates a new dictionary object that is an exact replica of the old object, except the entry specified by the *key* argument is deleted. The function returns a handle for the new dictionary object, or a null pointer on failure. On success, the original dictionary handle is destroyed.

**Returns:**

A handle for the new dictionary object, or a null pointer on failure.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_key\_get()***

*Find the key of a dictionary entry (returns a string)*

**Synopsis:**

```
#include <strm.h>

const char *strm_dict_key_get( const strm_dict_t *dict,
                               size_t n );
```

**Arguments:**

***dict***

A dictionary object handle.

***n***

The 0-based index of the entry whose key is returned.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_key\_get()* finds the key of the (*n*+1)th entry in the specified dictionary and returns it as a null-terminated string. For example, if *n* is 3, the key of the fourth entry is returned. The returned string is owned by the dictionary object, and remains valid until the dictionary handle is destroyed.

**Returns:**

The specified key on success, or a null pointer on failure.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_key\_rstr()***

*Find the key of a dictionary entry (returns a shareable string object handle)*

**Synopsis:**

```
#include <strm.h>

const strm_string_t *strm_dict_key_rstr(
    const strm_dict_t *dict,
    size_t n );
```

**Arguments:*****dict***

A handle to a dictionary object.

***n***

The 0-based index of the entry whose key is returned.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_key\_rstr()* finds the (*n*+1)th entry in the specified dictionary and returns a handle to the entry's key. For example, if *n* is 3, a handle to the key of the fourth entry is returned. The returned shareable string object handle is owned by the dictionary, and remains valid until the dictionary handle is destroyed.

**Returns:**

A shareable string object handle to the key of the specified entry if it's found, or a null pointer if it isn't found.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_new()***

*Create a new handle for an empty dictionary object*

**Synopsis:**

```
#include <strm.h>

strm_dict_t *strm_dict_new( void );
```

**Library:**

libstrm

**Description:**

The function *strm\_dict\_new()* creates a new empty dictionary object and returns a new handle to it.

Note that multiple handles may be represented by identical pointer values; you should not compare handles.

**Returns:**

A new dictionary object handle.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_set()***

*Modify a dictionary entry (using key-value strings)*

**Synopsis:**

```
#include <strm.h>

strm_dict_t *strm_dict_set( strm_dict_t *dict,
                           const char *key,
                           const char *value );
```

**Arguments:**



***dict***

A dictionary object handle.

***key***

The key of the dictionary entry to add or modify.

***value***

The value of the dictionary entry to add or modify.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_set()* creates a new dictionary object that is an exact replica of the dictionary object specified by the *dict* argument, except that the entry specified by the *key* and *value* arguments is added or modified. A handle to the new dictionary object is returned. The original dictionary handle is destroyed on success.

**Returns:**

A handle to the new dictionary object on success, or a null pointer on failure.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_set\_rstr()***

*Modify a dictionary entry (using key-value shareable string objects)*

**Synopsis:**

```
#include <strm.h>

strm_dict_t *strm_dict_set_rstr( strm_dict_t *dict,
                                strm_string_t *key,
                                strm_string_t *value );
```

**Arguments:*****dict***

A dictionary object handle.

***key***

The key of the dictionary entry to add or modify.

***value***

The value of the dictionary entry to add or modify.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_set\_rstr()* creates a new dictionary object that is an exact replica of the dictionary object specified by the *dict* argument, except that the entry specified by the *key* and *value* arguments is added or modified. A handle to the new dictionary object is returned.

The original dictionary handle, and the handles to the *key* and *value* arguments are destroyed on success.

This function is equivalent to *strm\_dict\_set()*, except that it may be more efficient if you use clones of the same *key* handle repeatedly.

**Returns:**

A handle to the new dictionary object on success, or a null pointer on failure.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_size()***

*Return the number of entries in a dictionary*

**Synopsis:**

```
#include <strm.h>
size_t strm_dict_size( const strm_dict_t *dict );
```

**Arguments:*****dict***

A dictionary object handle.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_size()* returns the number of entries in the specified dictionary.

**Returns:**

The number of entries in the specified dictionary.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_subtract()***

*Subtract one dictionary from another*

**Synopsis:**

```
#include <strm.h>
strm_dict_t *strm_dict_subtract( strm_dict_t *left,
```

```
strm_dict_t const *right );
```

**Arguments:*****left***

A handle to the first dictionary object.

***right***

A handle to the second dictionary object.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_subtract()* creates a replica of the *left* dictionary object and removes all those entries that have matching keys in the *right* object regardless of their value.

Note that the *left* dictionary object handle is consumed by this function, even on a failure, but the *right* is not (unless it's the same handle). If the same handle is passed for both arguments, this function returns an empty dictionary object, without dismantling the dictionary object referenced by the function arguments.

**Returns:**

A new handle to the resulting dictionary object on success, or a null pointer on failure.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_value\_get()***

*Find the value of a dictionary entry based on the entry's index (returns a string)*

**Synopsis:**

```
#include <strm.h>

const char *strm_dict_value_get( const strm_dict_t *dict,
                                size_t n );
```

**Arguments:*****dict***

A dictionary object handle.

***n***

The 0-based index of the entry whose value is returned.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_value\_get()* returns the value of the (*n*+1)th entry in the dictionary as a null-terminated string. For example, if *n* is 3, the value of the fourth entry is returned. The returned string is owned by the dictionary object, and remains valid until the dictionary handle is destroyed.

**Returns:**

The specified key on success, or a null pointer on failure.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_dict\_value\_rstr()***

Find the value of a dictionary entry based on the entry's index (returns a shareable string object handle)

**Synopsis:**

```
#include <strm.h>

const strm_string_t *strm_dict_value_rstr(
    const strm_dict_t *dict,
    size_t n );
```

**Arguments:*****dict***

A handle to a dictionary object.

***n***

The 0-based index of the entry whose value is returned.

**Library:**

libstrm

**Description:**

The function *strm\_dict\_value\_rstr()* finds the (*n*+1)th entry in the dictionary, and returns a handle to shareable string object containing the entry's value. For example, if *n* is 3, a handle to a shareable string object containing the value of the fourth entry is returned. The returned string handle is owned by the dictionary object, and remains valid until the dictionary handle is destroyed.

**Returns:**

A shareable string object handle to the key of the specified entry if the entry is found, or a null pointer if it isn't found.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_string\_alloc()***

*Allocate a new shareable string object*

**Synopsis:**

```
#include <strm.h>

char *strm_string_alloc( size_t len,
                        strm_string_t **handle );
```

**Arguments:*****len***

The length of the string to make room for, not including the terminating '\0' character.

***handle***

A pointer to a variable where the new string handle will be stored.

**Library:**

libstrm

**Description:**

The function *strm\_string\_alloc()* allocates a new shareable string object to be filled in by the caller. The caller must put a null-terminated string in the buffer of the new string object before calling any of the functions *strm\_string\_clone()*, *strm\_string\_modify()*, or *strm\_string\_destroy()*, and must not modify the buffer afterwards.

**Returns:**

A pointer to the first byte of the new string object's string buffer, or a null pointer on error. The new string handle is stored in the variable pointed to by the function argument *handle*.

**Classification:**

QNX Neutrino

<b>Safety:</b>	
Interrupt handler	No
Signal handler	No

Safety:	
Thread	Yes

***strm\_string\_clone()***

Create a new handle to an existing shareable string object

**Synopsis:**

```
#include <strm.h>

strm_string_t *strm_string_clone( const strm_string_t *sstr );
```

**Arguments:**

***sstr***

A handle to a shareable string object.

**Library:**

libstrm

**Description:**

The function *strm\_string\_clone()* creates a new string handle to the shareable string object referenced by the argument *sstr*.

**Returns:**

A new handle to the shareable string handle on success, or a null pointer on failure (*errno* is set).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes



***strm\_string\_destroy()****Destroy a string handle***Synopsis:**

```
#include <strm.h>
int strm_string_destroy( strm_string_t *sstr );
```

**Arguments:*****sstr***

A handle to a shareable string object.

**Library:**

libstrm

**Description:**

The function *strm\_string\_destroy()* destroys the specified string handle, and frees the memory allocated for the string object if the specified handle is the last one referencing it.

**Returns:**

0

Success.

-1

An error occurred (*errno* is set).**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_string\_get()***

*Return a pointer to the first character of the string*

**Synopsis:**

```
#include <strm.h>
const char *strm_string_get( const strm_string_t *sstr );
```

**Arguments:**

***sstr***

A handle to a shareable string object.

**Library:**

libstrm

**Description:**

The function *strm\_string\_get()* returns a pointer to the first character of the string in the shareable string object referenced by the *sstr* argument. This string should be considered read only; your application shouldn't attempt to modify it.

**Returns:**

A pointer to the first character of the string in the shareable string object referenced by the *sstr* argument.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_string\_make()***

*Create a new shareable string object*

**Synopsis:**

```
#include <strm.h>
strm_string_t *strm_string_make( const char *cstring );
```

**Arguments:**

***cstring***

A pointer to a null-terminated string.

**Library:**

libstrm

**Description:**

The function *strm\_string\_make()* creates a new shareable string object, populating it with the string passed in the *cstring* argument, and returning a handle to the new string object.

**Returns:**

A handle to the new string object.

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

***strm\_string\_modify()***

*Modify a shareable string object (destroying the existing handle)*

**Synopsis:**

```
#include <strm.h>
```

```
strm_string_t *strm_string_modify( strm_string_t *sstr,  
                                  const char *cstring );
```

**Arguments:*****sstr***

A handle to a shareable string object.

***cstring***

A pointer to a null-terminated string.

**Library:**

libstrm

**Description:**

The function *strm\_string\_modify()* creates a new shareable string object from the string passed in the *cstring* argument, and returns a new handle to the new string object. Calling *strm\_string\_modify()* is equivalent to calling *strm\_string\_destroy()* and *strm\_string\_make()*, except that it may reuse the original object's memory. The shareable string object handle passed in the *sstr* argument is consumed, even on failure.

**Returns:**

A new handle to the new shareable string object on success, or a null pointer on failure (*errno* is set).

**Classification:**

QNX Neutrino

Safety:	
Interrupt handler	No
Signal handler	No
Thread	Yes

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