

# The ALSA Driver API

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# **Chapter 1. Management of Cards and Devices**

## **Card Management**

## Name

`snd_device_initialize` — Initialize struct device for sound devices

## Synopsis

```
void snd_device_initialize (struct device * dev, struct snd_card * card);
```

## Arguments

*dev*    device to initialize

*card*   card to assign, optional

## Name

`snd_card_new` — create and initialize a soundcard structure

## Synopsis

```
int snd_card_new (struct device * parent, int idx, const char * xid,  
struct module * module, int extra_size, struct snd_card ** card_ret);
```

## Arguments

|                   |                                                             |
|-------------------|-------------------------------------------------------------|
| <i>parent</i>     | the parent device object                                    |
| <i>idx</i>        | card index (address) [0 ... (SNDRV_CARDS-1)]                |
| <i>xid</i>        | card identification (ASCII string)                          |
| <i>module</i>     | top level module for locking                                |
| <i>extra_size</i> | allocate this extra size after the main soundcard structure |
| <i>card_ret</i>   | the pointer to store the created card instance              |

## Description

Creates and initializes a soundcard structure.

The function allocates `snd_card` instance via `kzalloc` with the given space for the driver to use freely. The allocated struct is stored in the given `card_ret` pointer.

## Return

Zero if successful or a negative error code.

## Name

`snd_card_disconnect` — disconnect all APIs from the file-operations (user space)

## Synopsis

```
int snd_card_disconnect (struct snd_card * card);
```

## Arguments

*card*    soundcard structure

## Description

Disconnects all APIs from the file-operations (user space).

## Return

Zero, otherwise a negative error code.

## Note

The current implementation replaces all active file->f\_op with special dummy file operations (they do nothing except release).

## Name

`snd_card_free_when_closed` — Disconnect the card, free it later eventually

## Synopsis

```
int snd_card_free_when_closed (struct snd_card * card);
```

## Arguments

*card*    soundcard structure

## Description

Unlike `snd_card_free`, this function doesn't try to release the card resource immediately, but tries to disconnect at first. When the card is still in use, the function returns before freeing the resources. The card resources will be freed when the refcount gets to zero.

## Name

`snd_card_free` — frees given soundcard structure

## Synopsis

```
int snd_card_free (struct snd_card * card);
```

## Arguments

*card*    soundcard structure

## Description

This function releases the soundcard structure and the all assigned devices automatically. That is, you don't have to release the devices by yourself.

This function waits until the all resources are properly released.

## Return

Zero. Frees all associated devices and frees the control interface associated to given soundcard.

## Name

`snd_card_set_id` — set card identification name

## Synopsis

```
void snd_card_set_id (struct snd_card * card, const char * nid);
```

## Arguments

*card*    soundcard structure

*nid*     new identification string

## Description

This function sets the card identification and checks for name collisions.

## Name

`snd_card_add_dev_attr` — Append a new sysfs attribute group to card

## Synopsis

```
int snd_card_add_dev_attr (struct snd_card * card, const struct  
attribute_group * group);
```

## Arguments

*card*    card instance

*group*   attribute group to append

## Name

`snd_card_register` — register the soundcard

## Synopsis

```
int snd_card_register (struct snd_card * card);
```

## Arguments

*card*    soundcard structure

## Description

This function registers all the devices assigned to the soundcard. Until calling this, the ALSA control interface is blocked from the external accesses. Thus, you should call this function at the end of the initialization of the card.

## Return

Zero otherwise a negative error code if the registration failed.

## Name

`snd_component_add` — add a component string

## Synopsis

```
int snd_component_add (struct snd_card * card, const char * component);
```

## Arguments

*card*            soundcard structure

*component*    the component id string

## Description

This function adds the component id string to the supported list. The component can be referred from the `alsa-lib`.

## Return

Zero otherwise a negative error code.

## Name

`snd_card_file_add` — add the file to the file list of the card

## Synopsis

```
int snd_card_file_add (struct snd_card * card, struct file * file);
```

## Arguments

*card*    soundcard structure

*file*    file pointer

## Description

This function adds the file to the file linked-list of the card. This linked-list is used to keep tracking the connection state, and to avoid the release of busy resources by hotplug.

## Return

zero or a negative error code.

## Name

`snd_card_file_remove` — remove the file from the file list

## Synopsis

```
int snd_card_file_remove (struct snd_card * card, struct file * file);
```

## Arguments

*card*    soundcard structure

*file*    file pointer

## Description

This function removes the file formerly added to the card via `snd_card_file_add` function. If all files are removed and `snd_card_free_when_closed` was called beforehand, it processes the pending release of resources.

## Return

Zero or a negative error code.

## Name

`snd_power_wait` — wait until the power-state is changed.

## Synopsis

```
int snd_power_wait (struct snd_card * card, unsigned int power_state);
```

## Arguments

*card*                      soundcard structure

*power\_state*    expected power state

## Description

Waits until the power-state is changed.

## Return

Zero if successful, or a negative error code.

## Note

the power lock must be active before call.

# Device Components

## Name

`snd_device_new` — create an ALSA device component

## Synopsis

```
int snd_device_new (struct snd_card * card, enum snd_device_type type,  
void * device_data, struct snd_device_ops * ops);
```

## Arguments

|                    |                                 |
|--------------------|---------------------------------|
| <i>card</i>        | the card instance               |
| <i>type</i>        | the device type, SNDRV_DEV_XXX  |
| <i>device_data</i> | the data pointer of this device |
| <i>ops</i>         | the operator table              |

## Description

Creates a new device component for the given data pointer. The device will be assigned to the card and managed together by the card.

The data pointer plays a role as the identifier, too, so the pointer address must be unique and unchanged.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_device_disconnect` — disconnect the device

## Synopsis

```
void snd_device_disconnect (struct snd_card * card, void * device_data);
```

## Arguments

*card*                    the card instance

*device\_data*   the data pointer to disconnect

## Description

Turns the device into the disconnection state, invoking `dev_disconnect` callback, if the device was already registered.

Usually called from `snd_card_disconnect`.

## Return

Zero if successful, or a negative error code on failure or if the device not found.

## Name

`snd_device_free` — release the device from the card

## Synopsis

```
void snd_device_free (struct snd_card * card, void * device_data);
```

## Arguments

*card*                    the card instance

*device\_data*   the data pointer to release

## Description

Removes the device from the list on the card and invokes the callbacks, `dev_disconnect` and `dev_free`, corresponding to the state. Then release the device.

## Name

`snd_device_register` — register the device

## Synopsis

```
int snd_device_register (struct snd_card * card, void * device_data);
```

## Arguments

*card*                    the card instance

*device\_data*    the data pointer to register

## Description

Registers the device which was already created via `snd_device_new`. Usually this is called from `snd_card_register`, but it can be called later if any new devices are created after invocation of `snd_card_register`.

## Return

Zero if successful, or a negative error code on failure or if the device not found.

# Module requests and Device File Entries

## Name

`snd_request_card` — try to load the card module

## Synopsis

```
void snd_request_card (int card);
```

## Arguments

*card* the card number

## Description

Tries to load the module “snd-card-X” for the given card number via `request_module`. Returns immediately if already loaded.

## Name

`snd_lookup_minor_data` — get user data of a registered device

## Synopsis

```
void * snd_lookup_minor_data (unsigned int minor, int type);
```

## Arguments

*minor*    the minor number

*type*     device type (SNDRV\_DEVICE\_TYPE\_XXX)

## Description

Checks that a minor device with the specified type is registered, and returns its user data pointer.

This function increments the reference counter of the card instance if an associated instance with the given minor number and type is found. The caller must call `snd_card_unref` appropriately later.

## Return

The user data pointer if the specified device is found. `NULL` otherwise.

## Name

`snd_register_device` — Register the ALSA device file for the card

## Synopsis

```
int snd_register_device (int type, struct snd_card * card, int dev,  
const struct file_operations * f_ops, void * private_data, struct device  
* device);
```

## Arguments

|                     |                                        |
|---------------------|----------------------------------------|
| <i>type</i>         | the device type, SNDRV_DEVICE_TYPE_XXX |
| <i>card</i>         | the card instance                      |
| <i>dev</i>          | the device index                       |
| <i>f_ops</i>        | the file operations                    |
| <i>private_data</i> | user pointer for <i>f_ops</i> ->open   |
| <i>device</i>       | the device to register                 |

## Description

Registers an ALSA device file for the given card. The operators have to be set in *reg* parameter.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_unregister_device` — unregister the device on the given card

## Synopsis

```
int snd_unregister_device (struct device * dev);
```

## Arguments

*dev* the device instance

## Description

Unregisters the device file already registered via `snd_register_device`.

## Return

Zero if successful, or a negative error code on failure.

# Memory Management Helpers

## Name

`copy_to_user_fromio` — copy data from mmio-space to user-space

## Synopsis

```
int copy_to_user_fromio (void __user * dst, const volatile void __iomem
* src, size_t count);
```

## Arguments

*dst*      the destination pointer on user-space

*src*      the source pointer on mmio

*count*   the data size to copy in bytes

## Description

Copies the data from mmio-space to user-space.

## Return

Zero if successful, or non-zero on failure.

## Name

`copy_from_user_toio` — copy data from user-space to mmio-space

## Synopsis

```
int copy_from_user_toio (volatile void __iomem * dst, const void __user  
* src, size_t count);
```

## Arguments

*dst*      the destination pointer on mmio-space

*src*      the source pointer on user-space

*count*   the data size to copy in bytes

## Description

Copies the data from user-space to mmio-space.

## Return

Zero if successful, or non-zero on failure.

## Name

`snd_malloc_pages` — allocate pages with the given size

## Synopsis

```
void * snd_malloc_pages (size_t size, gfp_t gfp_flags);
```

## Arguments

*size*            the size to allocate in bytes

*gfp\_flags*    the allocation conditions, GFP\_XXX

## Description

Allocates the physically contiguous pages with the given size.

## Return

The pointer of the buffer, or NULL if no enough memory.

## Name

`snd_free_pages` — release the pages

## Synopsis

```
void snd_free_pages (void * ptr, size_t size);
```

## Arguments

*ptr*     the buffer pointer to release

*size*    the allocated buffer size

## Description

Releases the buffer allocated via `snd_malloc_pages`.

## Name

`snd_dma_alloc_pages` — allocate the buffer area according to the given type

## Synopsis

```
int snd_dma_alloc_pages (int type, struct device * device, size_t size,  
struct snd_dma_buffer * dmab);
```

## Arguments

*type*      the DMA buffer type

*device*    the device pointer

*size*      the buffer size to allocate

*dmab*      buffer allocation record to store the allocated data

## Description

Calls the memory-allocator function for the corresponding buffer type.

## Return

Zero if the buffer with the given size is allocated successfully, otherwise a negative value on error.

## Name

`snd_dma_alloc_pages_fallback` — allocate the buffer area according to the given type with fallback

## Synopsis

```
int snd_dma_alloc_pages_fallback (int type, struct device * device,
size_t size, struct snd_dma_buffer * dmab);
```

## Arguments

*type*      the DMA buffer type

*device*    the device pointer

*size*      the buffer size to allocate

*dmab*      buffer allocation record to store the allocated data

## Description

Calls the memory-allocator function for the corresponding buffer type. When no space is left, this function reduces the size and tries to allocate again. The size actually allocated is stored in `res_size` argument.

## Return

Zero if the buffer with the given size is allocated successfully, otherwise a negative value on error.

## Name

`snd_dma_free_pages` — release the allocated buffer

## Synopsis

```
void snd_dma_free_pages (struct snd_dma_buffer * dmab);
```

## Arguments

*dmab* the buffer allocation record to release

## Description

Releases the allocated buffer via `snd_dma_alloc_pages`.

---

# Chapter 2. PCM API

## PCM Core

## Name

`snd_pcm_format_name` — Return a name string for the given PCM format

## Synopsis

```
const char * snd_pcm_format_name (snd_pcm_format_t format);
```

## Arguments

*format*   PCM format

## Name

`snd_pcm_new_stream` — create a new PCM stream

## Synopsis

```
int  snd_pcm_new_stream (struct snd_pcm * pcm, int stream, int
                          substream_count);
```

## Arguments

|                        |                                                         |
|------------------------|---------------------------------------------------------|
| <i>pcm</i>             | the pcm instance                                        |
| <i>stream</i>          | the stream direction, <code>SNDRV_PCM_STREAM_XXX</code> |
| <i>substream_count</i> | the number of substreams                                |

## Description

Creates a new stream for the pcm. The corresponding stream on the pcm must have been empty before calling this, i.e. zero must be given to the argument of `snd_pcm_new`.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_new` — create a new PCM instance

## Synopsis

```
int snd_pcm_new (struct snd_card * card, const char * id, int device,  
int playback_count, int capture_count, struct snd_pcm ** rpcm);
```

## Arguments

|                       |                                           |
|-----------------------|-------------------------------------------|
| <i>card</i>           | the card instance                         |
| <i>id</i>             | the id string                             |
| <i>device</i>         | the device index (zero based)             |
| <i>playback_count</i> | the number of substreams for playback     |
| <i>capture_count</i>  | the number of substreams for capture      |
| <i>rpcm</i>           | the pointer to store the new pcm instance |

## Description

Creates a new PCM instance.

The pcm operators have to be set afterwards to the new instance via `snd_pcm_set_ops`.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_new_internal` — create a new internal PCM instance

## Synopsis

```
int snd_pcm_new_internal (struct snd_card * card, const char * id, int
device, int playback_count, int capture_count, struct snd_pcm ** rpcm);
```

## Arguments

|                       |                                                          |
|-----------------------|----------------------------------------------------------|
| <i>card</i>           | the card instance                                        |
| <i>id</i>             | the id string                                            |
| <i>device</i>         | the device index (zero based - shared with normal PCM's) |
| <i>playback_count</i> | the number of substreams for playback                    |
| <i>capture_count</i>  | the number of substreams for capture                     |
| <i>rpcm</i>           | the pointer to store the new pcm instance                |

## Description

Creates a new internal PCM instance with no userspace device or procfs entries. This is used by ASoC Back End PCM's in order to create a PCM that will only be used internally by kernel drivers. i.e. it cannot be opened by userspace. It provides existing ASoC components drivers with a substream and access to any private data.

The pcm operators have to be set afterwards to the new instance via `snd_pcm_set_ops`.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_notify` — Add/remove the notify list

## Synopsis

```
int snd_pcm_notify (struct snd_pcm_notify * notify, int nfree);
```

## Arguments

*notify*    PCM notify list

*nfree*     0 = register, 1 = unregister

## Description

This adds the given notifier to the global list so that the callback is called for each registered PCM devices. This exists only for PCM OSS emulation, so far.

## Name

`snd_pcm_set_ops` — set the PCM operators

## Synopsis

```
void snd_pcm_set_ops (struct snd_pcm * pcm, int direction, const struct  
snd_pcm_ops * ops);
```

## Arguments

|                  |                                                     |
|------------------|-----------------------------------------------------|
| <i>pcm</i>       | the pcm instance                                    |
| <i>direction</i> | stream direction, <code>SNDRV_PCM_STREAM_XXX</code> |
| <i>ops</i>       | the operator table                                  |

## Description

Sets the given PCM operators to the pcm instance.

## Name

`snd_pcm_set_sync` — set the PCM sync id

## Synopsis

```
void snd_pcm_set_sync (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the pcm substream

## Description

Sets the PCM sync identifier for the card.

## Name

`snd_interval_refine` — refine the interval value of configurator

## Synopsis

```
int snd_interval_refine (struct snd_interval * i, const struct
snd_interval * v);
```

## Arguments

*i* the interval value to refine

*v* the interval value to refer to

## Description

Refines the interval value with the reference value. The interval is changed to the range satisfying both intervals. The interval status (min, max, integer, etc.) are evaluated.

## Return

Positive if the value is changed, zero if it's not changed, or a negative error code.

## Name

`snd_interval_ratnum` — refine the interval value

## Synopsis

```
int snd_interval_ratnum (struct snd_interval * i, unsigned int
    rats_count, const struct snd_ratnum * rats, unsigned int * nump, un-
    signed int * denp);
```

## Arguments

|                   |                                            |
|-------------------|--------------------------------------------|
| <i>i</i>          | interval to refine                         |
| <i>rats_count</i> | number of <code>ratnum_t</code>            |
| <i>rats</i>       | <code>ratnum_t</code> array                |
| <i>nump</i>       | pointer to store the resultant numerator   |
| <i>denp</i>       | pointer to store the resultant denominator |

## Return

Positive if the value is changed, zero if it's not changed, or a negative error code.

## Name

`snd_interval_list` — refine the interval value from the list

## Synopsis

```
int snd_interval_list (struct snd_interval * i, unsigned int count,  
const unsigned int * list, unsigned int mask);
```

## Arguments

*i*            the interval value to refine

*count*      the number of elements in the list

*list*        the value list

*mask*        the bit-mask to evaluate

## Description

Refines the interval value from the list. When mask is non-zero, only the elements corresponding to bit 1 are evaluated.

## Return

Positive if the value is changed, zero if it's not changed, or a negative error code.

## Name

`snd_interval_ranges` — refine the interval value from the list of ranges

## Synopsis

```
int snd_interval_ranges (struct snd_interval * i, unsigned int count,  
const struct snd_interval * ranges, unsigned int mask);
```

## Arguments

|               |                                              |
|---------------|----------------------------------------------|
| <i>i</i>      | the interval value to refine                 |
| <i>count</i>  | the number of elements in the list of ranges |
| <i>ranges</i> | the ranges list                              |
| <i>mask</i>   | the bit-mask to evaluate                     |

## Description

Refines the interval value from the list of ranges. When mask is non-zero, only the elements corresponding to bit 1 are evaluated.

## Return

Positive if the value is changed, zero if it's not changed, or a negative error code.

## Name

`snd_pcm_hw_rule_add` — add the hw-constraint rule

## Synopsis

```
int snd_pcm_hw_rule_add (struct snd_pcm_runtime * runtime, unsigned int
cond, int var, snd_pcm_hw_rule_func_t func, void * private, int dep,
...);
```

## Arguments

|                |                                             |
|----------------|---------------------------------------------|
| <i>runtime</i> | the pcm runtime instance                    |
| <i>cond</i>    | condition bits                              |
| <i>var</i>     | the variable to evaluate                    |
| <i>func</i>    | the evaluation function                     |
| <i>private</i> | the private data pointer passed to function |
| <i>dep</i>     | the dependent variables                     |
| ...            | variable arguments                          |

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_hw_constraint_mask64` — apply the given bitmap mask constraint

## Synopsis

```
int snd_pcm_hw_constraint_mask64 (struct snd_pcm_runtime * runtime,
snd_pcm_hw_param_t var, u_int64_t mask);
```

## Arguments

*runtime*    PCM runtime instance

*var*        hw\_params variable to apply the mask

*mask*       the 64bit bitmap mask

## Description

Apply the constraint of the given bitmap mask to a 64-bit mask parameter.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_hw_constraint_integer` — apply an integer constraint to an interval

## Synopsis

```
int snd_pcm_hw_constraint_integer (struct snd_pcm_runtime * runtime,  
snd_pcm_hw_param_t var);
```

## Arguments

*runtime*    PCM runtime instance

*var*        hw\_params variable to apply the integer constraint

## Description

Apply the constraint of integer to an interval parameter.

## Return

Positive if the value is changed, zero if it's not changed, or a negative error code.

## Name

`snd_pcm_hw_constraint_minmax` — apply a min/max range constraint to an interval

## Synopsis

```
int snd_pcm_hw_constraint_minmax (struct snd_pcm_runtime * runtime,  
snd_pcm_hw_param_t var, unsigned int min, unsigned int max);
```

## Arguments

|                |                                       |
|----------------|---------------------------------------|
| <i>runtime</i> | PCM runtime instance                  |
| <i>var</i>     | hw_params variable to apply the range |
| <i>min</i>     | the minimal value                     |
| <i>max</i>     | the maximal value                     |

## Description

Apply the min/max range constraint to an interval parameter.

## Return

Positive if the value is changed, zero if it's not changed, or a negative error code.

## Name

`snd_pcm_hw_constraint_list` — apply a list of constraints to a parameter

## Synopsis

```
int  snd_pcm_hw_constraint_list (struct snd_pcm_runtime * runtime,
                                unsigned int cond, snd_pcm_hw_param_t var,
                                const struct snd_pcm_hw_constraint_list * l);
```

## Arguments

|                |                                                 |
|----------------|-------------------------------------------------|
| <i>runtime</i> | PCM runtime instance                            |
| <i>cond</i>    | condition bits                                  |
| <i>var</i>     | hw_params variable to apply the list constraint |
| <i>l</i>       | list                                            |

## Description

Apply the list of constraints to an interval parameter.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_hw_constraint_ranges` — apply list of range constraints to a parameter

## Synopsis

```
int snd_pcm_hw_constraint_ranges (struct snd_pcm_runtime * runtime,
    unsigned int cond, snd_pcm_hw_param_t var, const struct
    snd_pcm_hw_constraint_ranges * r);
```

## Arguments

|                |                                                           |
|----------------|-----------------------------------------------------------|
| <i>runtime</i> | PCM runtime instance                                      |
| <i>cond</i>    | condition bits                                            |
| <i>var</i>     | hw_params variable to apply the list of range constraints |
| <i>r</i>       | ranges                                                    |

## Description

Apply the list of range constraints to an interval parameter.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_hw_constraint_ratnums` — apply ratnums constraint to a parameter

## Synopsis

```
int  snd_pcm_hw_constraint_ratnums (struct snd_pcm_runtime * runtime,
                                     unsigned int cond, snd_pcm_hw_param_t var,
                                     const struct snd_pcm_hw_constraint_ratnums * r);
```

## Arguments

|                |                                                    |
|----------------|----------------------------------------------------|
| <i>runtime</i> | PCM runtime instance                               |
| <i>cond</i>    | condition bits                                     |
| <i>var</i>     | hw_params variable to apply the ratnums constraint |
| <i>r</i>       | struct snd_ratnums constraints                     |

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_hw_constraint_ratdens` — apply ratdens constraint to a parameter

## Synopsis

```
int  snd_pcm_hw_constraint_ratdens (struct snd_pcm_runtime * runtime,
                                     unsigned int cond, snd_pcm_hw_param_t var,
                                     const struct snd_pcm_hw_constraint_ratdens * r);
```

## Arguments

|                |                                                    |
|----------------|----------------------------------------------------|
| <i>runtime</i> | PCM runtime instance                               |
| <i>cond</i>    | condition bits                                     |
| <i>var</i>     | hw_params variable to apply the ratdens constraint |
| <i>r</i>       | struct <code>snd_ratdens</code> constraints        |

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_hw_constraint_msbits` — add a hw constraint msbits rule

## Synopsis

```
int snd_pcm_hw_constraint_msbits (struct snd_pcm_runtime * runtime, unsigned int cond, unsigned int width, unsigned int msbits);
```

## Arguments

*runtime*    PCM runtime instance

*cond*       condition bits

*width*      sample bits width

*msbits*     msbits width

## Description

This constraint will set the number of most significant bits (msbits) if a sample format with the specified width has been select. If width is set to 0 the msbits will be set for any sample format with a width larger than the specified msbits.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_hw_constraint_step` — add a hw constraint step rule

## Synopsis

```
int snd_pcm_hw_constraint_step (struct snd_pcm_runtime * runtime, unsigned int cond, snd_pcm_hw_param_t var, unsigned long step);
```

## Arguments

*runtime*    PCM runtime instance

*cond*       condition bits

*var*        hw\_params variable to apply the step constraint

*step*       step size

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_hw_constraint_pow2` — add a hw constraint power-of-2 rule

## Synopsis

```
int snd_pcm_hw_constraint_pow2 (struct snd_pcm_runtime * runtime, unsigned int cond, snd_pcm_hw_param_t var);
```

## Arguments

*runtime*    PCM runtime instance

*cond*       condition bits

*var*        hw\_params variable to apply the power-of-2 constraint

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_hw_rule_noresample` — add a rule to allow disabling hw resampling

## Synopsis

```
int snd_pcm_hw_rule_noresample (struct snd_pcm_runtime * runtime, unsigned int base_rate);
```

## Arguments

*runtime*      PCM runtime instance

*base\_rate*    the rate at which the hardware does not resample

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_hw_param_value` — return *params* field *var* value

## Synopsis

```
int snd_pcm_hw_param_value (const struct snd_pcm_hw_params * params,  
snd_pcm_hw_param_t var, int * dir);
```

## Arguments

*params*    the hw\_params instance

*var*       parameter to retrieve

*dir*       pointer to the direction (-1,0,1) or NULL

## Return

The value for field *var* if it's fixed in configuration space defined by *params*. -EINVAL otherwise.

## Name

`snd_pcm_hw_param_first` — refine config space and return minimum value

## Synopsis

```
int snd_pcm_hw_param_first (struct snd_pcm_substream * pcm, struct
snd_pcm_hw_params * params, snd_pcm_hw_param_t var, int * dir);
```

## Arguments

|               |                                           |
|---------------|-------------------------------------------|
| <i>pcm</i>    | PCM instance                              |
| <i>params</i> | the hw_params instance                    |
| <i>var</i>    | parameter to retrieve                     |
| <i>dir</i>    | pointer to the direction (-1,0,1) or NULL |

## Description

Inside configuration space defined by *params* remove from *var* all values > minimum. Reduce configuration space accordingly.

## Return

The minimum, or a negative error code on failure.

## Name

`snd_pcm_hw_param_last` — refine config space and return maximum value

## Synopsis

```
int  snd_pcm_hw_param_last (struct snd_pcm_substream * pcm, struct
snd_pcm_hw_params * params, snd_pcm_hw_param_t var, int * dir);
```

## Arguments

|               |                                           |
|---------------|-------------------------------------------|
| <i>pcm</i>    | PCM instance                              |
| <i>params</i> | the hw_params instance                    |
| <i>var</i>    | parameter to retrieve                     |
| <i>dir</i>    | pointer to the direction (-1,0,1) or NULL |

## Description

Inside configuration space defined by *params* remove from *var* all values < maximum. Reduce configuration space accordingly.

## Return

The maximum, or a negative error code on failure.

## Name

`snd_pcm_lib_ioctl` — a generic PCM ioctl callback

## Synopsis

```
int snd_pcm_lib_ioctl (struct snd_pcm_substream * substream, unsigned
int cmd, void * arg);
```

## Arguments

*substream*    the pcm substream instance

*cmd*            ioctl command

*arg*            ioctl argument

## Description

Processes the generic ioctl commands for PCM. Can be passed as the ioctl callback for PCM ops.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_period_elapsed` — update the pcm status for the next period

## Synopsis

```
void snd_pcm_period_elapsed (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the pcm substream instance

## Description

This function is called from the interrupt handler when the PCM has processed the period size. It will update the current pointer, wake up sleepers, etc.

Even if more than one periods have elapsed since the last call, you have to call this only once.

## Name

`snd_pcm_add_chmap_ctls` — create channel-mapping control elements

## Synopsis

```
int snd_pcm_add_chmap_ctls (struct snd_pcm * pcm, int stream, const struct snd_pcm_chmap_elem * chmap, int max_channels, unsigned long private_value, struct snd_pcm_chmap ** info_ret);
```

## Arguments

|                      |                                                                      |
|----------------------|----------------------------------------------------------------------|
| <i>pcm</i>           | the assigned PCM instance                                            |
| <i>stream</i>        | stream direction                                                     |
| <i>chmap</i>         | channel map elements (for query)                                     |
| <i>max_channels</i>  | the max number of channels for the stream                            |
| <i>private_value</i> | the value passed to each kcontrol's <code>private_value</code> field |
| <i>info_ret</i>      | store struct <code>snd_pcm_chmap</code> instance if non-NULL         |

## Description

Create channel-mapping control elements assigned to the given PCM stream(s).

## Return

Zero if successful, or a negative error value.

## Name

`snd_pcm_stream_lock` — Lock the PCM stream

## Synopsis

```
void snd_pcm_stream_lock (struct snd_pcm_substream * substream);
```

## Arguments

*substream*    PCM substream

## Description

This locks the PCM stream's spinlock or mutex depending on the nonatomic flag of the given substream. This also takes the global link rw lock (or rw sem), too, for avoiding the race with linked streams.

## Name

`snd_pcm_stream_unlock` — Unlock the PCM stream

## Synopsis

```
void snd_pcm_stream_unlock (struct snd_pcm_substream * substream);
```

## Arguments

*substream*   PCM substream

## Description

This unlocks the PCM stream that has been locked via `snd_pcm_stream_lock`.

## Name

`snd_pcm_stream_lock_irq` — Lock the PCM stream

## Synopsis

```
void snd_pcm_stream_lock_irq (struct snd_pcm_substream * substream);
```

## Arguments

*substream*    PCM substream

## Description

This locks the PCM stream like `snd_pcm_stream_lock` and disables the local IRQ (only when `nonatomic` is false). In nonatomic case, this is identical as `snd_pcm_stream_lock`.

## Name

`snd_pcm_stream_unlock_irq` — Unlock the PCM stream

## Synopsis

```
void snd_pcm_stream_unlock_irq (struct snd_pcm_substream * substream);
```

## Arguments

*substream*    PCM substream

## Description

This is a counter-part of `snd_pcm_stream_lock_irq`.

## Name

`snd_pcm_stream_unlock_irqrestore` — Unlock the PCM stream

## Synopsis

```
void snd_pcm_stream_unlock_irqrestore (struct snd_pcm_substream * sub-  
stream, unsigned long flags);
```

## Arguments

*substream*    PCM substream

*flags*        irq flags

## Description

This is a counter-part of `snd_pcm_stream_lock_irqsave`.

## Name

`snd_pcm_stop` — try to stop all running streams in the substream group

## Synopsis

```
int snd_pcm_stop (struct snd_pcm_substream * substream, snd_pcm_state_t
state);
```

## Arguments

*substream*    the PCM substream instance

*state*        PCM state after stopping the stream

## Description

The state of each stream is then changed to the given state unconditionally.

## Return

Zero if successful, or a negative error code.

## Name

`snd_pcm_stop_xrun` — stop the running streams as XRUN

## Synopsis

```
int snd_pcm_stop_xrun (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the PCM substream instance

## Description

This stops the given running substream (and all linked substreams) as XRUN. Unlike `snd_pcm_stop`, this function takes the substream lock by itself.

## Return

Zero if successful, or a negative error code.

## Name

`snd_pcm_suspend` — trigger SUSPEND to all linked streams

## Synopsis

```
int snd_pcm_suspend (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the PCM substream

## Description

After this call, all streams are changed to SUSPENDED state.

## Return

Zero if successful (or *substream* is NULL), or a negative error code.

## Name

`snd_pcm_suspend_all` — trigger SUSPEND to all substreams in the given pcm

## Synopsis

```
int snd_pcm_suspend_all (struct snd_pcm * pcm);
```

## Arguments

*pcm* the PCM instance

## Description

After this call, all streams are changed to SUSPENDED state.

## Return

Zero if successful (or *pcm* is NULL), or a negative error code.

## Name

`snd_pcm_lib_default_mmap` — Default PCM data mmap function

## Synopsis

```
int snd_pcm_lib_default_mmap (struct snd_pcm_substream * substream,
struct vm_area_struct * area);
```

## Arguments

*substream*    PCM substream

*area*         VMA

## Description

This is the default mmap handler for PCM data. When `mmap_pcm_ops` is `NULL`, this function is invoked implicitly.

## Name

`snd_pcm_lib_mmap_iomem` — Default PCM data mmap function for I/O mem

## Synopsis

```
int snd_pcm_lib_mmap_iomem (struct snd_pcm_substream * substream, struct
vm_area_struct * area);
```

## Arguments

*substream*    PCM substream

*area*        VMA

## Description

When your hardware uses the iomapped pages as the hardware buffer and wants to mmap it, pass this function as `mmap_pcm_ops`. Note that this is supposed to work only on limited architectures.

## Name

`snd_pcm_stream_linked` — Check whether the substream is linked with others

## Synopsis

```
int snd_pcm_stream_linked (struct snd_pcm_substream * substream);
```

## Arguments

*substream*    substream to check

## Description

Returns true if the given substream is being linked with others.

## Name

`snd_pcm_stream_lock_irqsave` — Lock the PCM stream

## Synopsis

```
snd_pcm_stream_lock_irqsave ( substream, flags );
```

## Arguments

*substream*    PCM substream

*flags*        irq flags

## Description

This locks the PCM stream like `snd_pcm_stream_lock` but with the local IRQ (only when `nonatomic` is false). In nonatomic case, this is identical as `snd_pcm_stream_lock`.

## Name

`snd_pcm_group_for_each_entry` — iterate over the linked substreams

## Synopsis

```
snd_pcm_group_for_each_entry ( s, substream );
```

## Arguments

*s*                    the iterator

*substream*   the substream

## Description

Iterate over the all linked substreams to the given *substream*. When *substream* isn't linked with any others, this gives returns *substream* itself once.

## Name

`snd_pcm_running` — Check whether the substream is in a running state

## Synopsis

```
int snd_pcm_running (struct snd_pcm_substream * substream);
```

## Arguments

*substream*    substream to check

## Description

Returns true if the given substream is in the state `RUNNING`, or in the state `DRAINING` for playback.

## Name

`bytes_to_samples` — Unit conversion of the size from bytes to samples

## Synopsis

```
ssize_t bytes_to_samples (struct snd_pcm_runtime * runtime, ssize_t  
size);
```

## Arguments

*runtime*    PCM runtime instance

*size*       size in bytes

## Name

`bytes_to_frames` — Unit conversion of the size from bytes to frames

## Synopsis

```
snd_pcm_sframes_t bytes_to_frames (struct snd_pcm_runtime * runtime,  
ssize_t size);
```

## Arguments

*runtime*    PCM runtime instance

*size*       size in bytes

## Name

`samples_to_bytes` — Unit conversion of the size from samples to bytes

## Synopsis

```
ssize_t samples_to_bytes (struct snd_pcm_runtime * runtime, ssize_t  
size);
```

## Arguments

*runtime*    PCM runtime instance

*size*       size in samples

## Name

`frames_to_bytes` — Unit conversion of the size from frames to bytes

## Synopsis

```
ssize_t frames_to_bytes (struct snd_pcm_runtime * runtime,  
snd_pcm_sframes_t size);
```

## Arguments

*runtime* PCM runtime instance

*size* size in frames

## Name

`frame_aligned` — Check whether the byte size is aligned to frames

## Synopsis

```
int frame_aligned (struct snd_pcm_runtime * runtime, ssize_t bytes);
```

## Arguments

*runtime*    PCM runtime instance

*bytes*      size in bytes

## Name

`snd_pcm_lib_buffer_bytes` — Get the buffer size of the current PCM in bytes

## Synopsis

```
size_t snd_pcm_lib_buffer_bytes (struct snd_pcm_substream * substream);
```

## Arguments

*substream*    PCM substream

## Name

`snd_pcm_lib_period_bytes` — Get the period size of the current PCM in bytes

## Synopsis

```
size_t snd_pcm_lib_period_bytes (struct snd_pcm_substream * substream);
```

## Arguments

*substream*   PCM substream

## Name

`snd_pcm_playback_avail` — Get the available (writable) space for playback

## Synopsis

```
snd_pcm_uframes_t snd_pcm_playback_avail (struct snd_pcm_runtime * runtime);
```

## Arguments

*runtime*    PCM runtime instance

## Description

Result is between 0 ... (boundary - 1)

## Name

`snd_pcm_capture_avail` — Get the available (readable) space for capture

## Synopsis

```
snd_pcm_uframes_t snd_pcm_capture_avail (struct snd_pcm_runtime * runtime);
```

## Arguments

*runtime*    PCM runtime instance

## Description

Result is between 0 ... (boundary - 1)

## Name

`snd_pcm_playback_hw_avail` — Get the queued space for playback

## Synopsis

```
snd_pcm_sframes_t snd_pcm_playback_hw_avail (struct snd_pcm_runtime *  
runtime);
```

## Arguments

*runtime*    PCM runtime instance

## Name

`snd_pcm_capture_hw_avail` — Get the free space for capture

## Synopsis

```
snd_pcm_sframes_t snd_pcm_capture_hw_avail (struct snd_pcm_runtime *  
runtime);
```

## Arguments

*runtime*   PCM runtime instance

## Name

`snd_pcm_playback_ready` — check whether the playback buffer is available

## Synopsis

```
int snd_pcm_playback_ready (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the pcm substream instance

## Description

Checks whether enough free space is available on the playback buffer.

## Return

Non-zero if available, or zero if not.

## Name

`snd_pcm_capture_ready` — check whether the capture buffer is available

## Synopsis

```
int snd_pcm_capture_ready (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the pcm substream instance

## Description

Checks whether enough capture data is available on the capture buffer.

## Return

Non-zero if available, or zero if not.

## Name

`snd_pcm_playback_data` — check whether any data exists on the playback buffer

## Synopsis

```
int snd_pcm_playback_data (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the pcm substream instance

## Description

Checks whether any data exists on the playback buffer.

## Return

Non-zero if any data exists, or zero if not. If `stop_threshold` is bigger or equal to `boundary`, then this function returns always non-zero.

## Name

`snd_pcm_playback_empty` — check whether the playback buffer is empty

## Synopsis

```
int snd_pcm_playback_empty (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the pcm substream instance

## Description

Checks whether the playback buffer is empty.

## Return

Non-zero if empty, or zero if not.

## Name

`snd_pcm_capture_empty` — check whether the capture buffer is empty

## Synopsis

```
int snd_pcm_capture_empty (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the pcm substream instance

## Description

Checks whether the capture buffer is empty.

## Return

Non-zero if empty, or zero if not.

## Name

`snd_pcm_trigger_done` — Mark the master substream

## Synopsis

```
void snd_pcm_trigger_done (struct snd_pcm_substream * substream, struct  
snd_pcm_substream * master);
```

## Arguments

*substream*    the pcm substream instance

*master*        the linked master substream

## Description

When multiple substreams of the same card are linked and the hardware supports the single-shot operation, the driver calls this in the loop in `snd_pcm_group_for_each_entry` for marking the substream as “done”. Then most of trigger operations are performed only to the given master substream.

The `trigger_master` mark is cleared at timestamp updates at the end of trigger operations.

## Name

`params_channels` — Get the number of channels from the hw params

## Synopsis

```
unsigned int params_channels (const struct snd_pcm_hw_params * p);
```

## Arguments

*p* hw params

## Name

`params_rate` — Get the sample rate from the hw params

## Synopsis

```
unsigned int params_rate (const struct snd_pcm_hw_params * p);
```

## Arguments

*p* hw params

## Name

`params_period_size` — Get the period size (in frames) from the hw params

## Synopsis

```
unsigned int params_period_size (const struct snd_pcm_hw_params * p);
```

## Arguments

*p* hw params

## Name

`params_periods` — Get the number of periods from the hw params

## Synopsis

```
unsigned int params_periods (const struct snd_pcm_hw_params * p);
```

## Arguments

*p* hw params

## Name

`params_buffer_size` — Get the buffer size (in frames) from the hw params

## Synopsis

```
unsigned int params_buffer_size (const struct snd_pcm_hw_params * p);
```

## Arguments

*p* hw params

## Name

`params_buffer_bytes` — Get the buffer size (in bytes) from the hw params

## Synopsis

```
unsigned int params_buffer_bytes (const struct snd_pcm_hw_params * p);
```

## Arguments

*p* hw params

## Name

`snd_pcm_hw_constraint_single` — Constrain parameter to a single value

## Synopsis

```
int snd_pcm_hw_constraint_single (struct snd_pcm_runtime * runtime,
snd_pcm_hw_param_t var, unsigned int val);
```

## Arguments

*runtime*    PCM runtime instance

*var*        The hw\_params variable to constrain

*val*        The value to constrain to

## Return

Positive if the value is changed, zero if it's not changed, or a negative error code.

## Name

`snd_pcm_format_cpu_endian` — Check the PCM format is CPU-endian

## Synopsis

```
int snd_pcm_format_cpu_endian (snd_pcm_format_t format);
```

## Arguments

*format* the format to check

## Return

1 if the given PCM format is CPU-endian, 0 if opposite, or a negative error code if endian not specified.

## Name

`snd_pcm_set_runtime_buffer` — Set the PCM runtime buffer

## Synopsis

```
void snd_pcm_set_runtime_buffer (struct snd_pcm_substream * substream,  
struct snd_dma_buffer * bufp);
```

## Arguments

*substream*    PCM substream to set

*bufp*            the buffer information, NULL to clear

## Description

Copy the buffer information to `runtime->dma_buffer` when *bufp* is non-NULL. Otherwise it clears the current buffer information.

## Name

`snd_pcm_gettime` — Fill the timespec depending on the timestamp mode

## Synopsis

```
void snd_pcm_gettime (struct snd_pcm_runtime * runtime, struct timespec  
* tv);
```

## Arguments

*runtime*    PCM runtime instance

*tv*        timespec to fill

## Name

`snd_pcm_lib_alloc_vmalloc_buffer` — allocate virtual DMA buffer

## Synopsis

```
int snd_pcm_lib_alloc_vmalloc_buffer (struct snd_pcm_substream * sub-  
stream, size_t size);
```

## Arguments

*substream*    the substream to allocate the buffer to

*size*            the requested buffer size, in bytes

## Description

Allocates the PCM substream buffer using `vmalloc`, i.e., the memory is contiguous in kernel virtual space, but not in physical memory. Use this if the buffer is accessed by kernel code but not by device DMA.

## Return

1 if the buffer was changed, 0 if not changed, or a negative error code.

## Name

`snd_pcm_lib_alloc_vmalloc_32_buffer` — allocate 32-bit-addressable buffer

## Synopsis

```
int snd_pcm_lib_alloc_vmalloc_32_buffer (struct snd_pcm_substream *  
    substream, size_t size);
```

## Arguments

*substream*    the substream to allocate the buffer to

*size*            the requested buffer size, in bytes

## Description

This function works like `snd_pcm_lib_alloc_vmalloc_buffer`, but uses `vmalloc_32`, i.e., the pages are allocated from 32-bit-addressable memory.

## Return

1 if the buffer was changed, 0 if not changed, or a negative error code.

## Name

`snd_pcm_sgbuf_get_addr` — Get the DMA address at the corresponding offset

## Synopsis

```
dma_addr_t snd_pcm_sgbuf_get_addr (struct snd_pcm_substream * sub-  
stream, unsigned int ofs);
```

## Arguments

*substream*    PCM substream

*ofs*            byte offset

## Name

`snd_pcm_sgbuf_get_ptr` — Get the virtual address at the corresponding offset

## Synopsis

```
void * snd_pcm_sgbuf_get_ptr (struct snd_pcm_substream * substream,  
unsigned int ofs);
```

## Arguments

*substream*    PCM substream

*ofs*            byte offset

## Name

`snd_pcm_sgbuf_get_chunk_size` — Compute the max size that fits within the contig. page from the given size

## Synopsis

```
unsigned int snd_pcm_sgbuf_get_chunk_size (struct snd_pcm_substream *  
substream, unsigned int ofs, unsigned int size);
```

## Arguments

*substream*    PCM substream

*ofs*            byte offset

*size*           byte size to examine

## Name

`snd_pcm_mmap_data_open` — increase the mmap counter

## Synopsis

```
void snd_pcm_mmap_data_open (struct vm_area_struct * area);
```

## Arguments

*area* VMA

## Description

PCM mmap callback should handle this counter properly

## Name

`snd_pcm_mmap_data_close` — decrease the mmap counter

## Synopsis

```
void snd_pcm_mmap_data_close (struct vm_area_struct * area);
```

## Arguments

*area* VMA

## Description

PCM mmap callback should handle this counter properly

## Name

`snd_pcm_limit_isa_dma_size` — Get the max size fitting with ISA DMA transfer

## Synopsis

```
void snd_pcm_limit_isa_dma_size (int dma, size_t * max);
```

## Arguments

*dma* DMA number

*max* pointer to store the max size

## Name

`snd_pcm_stream_str` — Get a string naming the direction of a stream

## Synopsis

```
const char * snd_pcm_stream_str (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the pcm substream instance

## Return

A string naming the direction of the stream.

## Name

`snd_pcm_chmap_substream` — get the PCM substream assigned to the given chmap info

## Synopsis

```
struct snd_pcm_substream * snd_pcm_chmap_substream (struct
snd_pcm_chmap * info, unsigned int idx);
```

## Arguments

*info* chmap information

*idx* the substream number index

## Name

`pcm_format_to_bits` — Strong-typed conversion of `pcm_format` to bitwise

## Synopsis

```
u64 pcm_format_to_bits (snd_pcm_format_t pcm_format);
```

## Arguments

*pcm\_format*    PCM format

## PCM Format Helpers

## Name

`snd_pcm_format_signed` — Check the PCM format is signed linear

## Synopsis

```
int snd_pcm_format_signed (snd_pcm_format_t format);
```

## Arguments

*format* the format to check

## Return

1 if the given PCM format is signed linear, 0 if unsigned linear, and a negative error code for non-linear formats.

## Name

`snd_pcm_format_unsigned` — Check the PCM format is unsigned linear

## Synopsis

```
int snd_pcm_format_unsigned (snd_pcm_format_t format);
```

## Arguments

*format* the format to check

## Return

1 if the given PCM format is unsigned linear, 0 if signed linear, and a negative error code for non-linear formats.

## Name

`snd_pcm_format_linear` — Check the PCM format is linear

## Synopsis

```
int snd_pcm_format_linear (snd_pcm_format_t format);
```

## Arguments

*format* the format to check

## Return

1 if the given PCM format is linear, 0 if not.

## Name

`snd_pcm_format_little_endian` — Check the PCM format is little-endian

## Synopsis

```
int snd_pcm_format_little_endian (snd_pcm_format_t format);
```

## Arguments

*format* the format to check

## Return

1 if the given PCM format is little-endian, 0 if big-endian, or a negative error code if endian not specified.

## Name

`snd_pcm_format_big_endian` — Check the PCM format is big-endian

## Synopsis

```
int snd_pcm_format_big_endian (snd_pcm_format_t format);
```

## Arguments

*format* the format to check

## Return

1 if the given PCM format is big-endian, 0 if little-endian, or a negative error code if endian not specified.

## Name

`snd_pcm_format_width` — return the bit-width of the format

## Synopsis

```
int snd_pcm_format_width (snd_pcm_format_t format);
```

## Arguments

*format* the format to check

## Return

The bit-width of the format, or a negative error code if unknown format.

## Name

`snd_pcm_format_physical_width` — return the physical bit-width of the format

## Synopsis

```
int snd_pcm_format_physical_width (snd_pcm_format_t format);
```

## Arguments

*format* the format to check

## Return

The physical bit-width of the format, or a negative error code if unknown format.

## Name

`snd_pcm_format_size` — return the byte size of samples on the given format

## Synopsis

```
ssize_t snd_pcm_format_size (snd_pcm_format_t format, size_t samples);
```

## Arguments

*format*     the format to check

*samples*   sampling rate

## Return

The byte size of the given samples for the format, or a negative error code if unknown format.

## Name

`snd_pcm_format_silence_64` — return the silent data in 8 bytes array

## Synopsis

```
const unsigned char * snd_pcm_format_silence_64 (snd_pcm_format_t format);
```

## Arguments

*format* the format to check

## Return

The format pattern to fill or NULL if error.

## Name

`snd_pcm_format_set_silence` — set the silence data on the buffer

## Synopsis

```
int snd_pcm_format_set_silence (snd_pcm_format_t format, void * data,  
unsigned int samples);
```

## Arguments

*format*     the PCM format

*data*       the buffer pointer

*samples*   the number of samples to set silence

## Description

Sets the silence data on the buffer for the given samples.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_limit_hw_rates` — determine rate\_min/rate\_max fields

## Synopsis

```
int snd_pcm_limit_hw_rates (struct snd_pcm_runtime * runtime);
```

## Arguments

*runtime* the runtime instance

## Description

Determines the rate\_min and rate\_max fields from the rates bits of the given runtime->hw.

## Return

Zero if successful.

## Name

`snd_pcm_rate_to_rate_bit` — converts sample rate to SNDRV\_PCM\_RATE\_XXX bit

## Synopsis

```
unsigned int snd_pcm_rate_to_rate_bit (unsigned int rate);
```

## Arguments

*rate* the sample rate to convert

## Return

The SNDRV\_PCM\_RATE\_XXX flag that corresponds to the given rate, or SNDRV\_PCM\_RATE\_KNOT for an unknown rate.

## Name

`snd_pcm_rate_bit_to_rate` — converts SNDRV\_PCM\_RATE\_XXX bit to sample rate

## Synopsis

```
unsigned int snd_pcm_rate_bit_to_rate (unsigned int rate_bit);
```

## Arguments

*rate\_bit* the rate bit to convert

## Return

The sample rate that corresponds to the given SNDRV\_PCM\_RATE\_XXX flag or 0 for an unknown rate bit.

## Name

`snd_pcm_rate_mask_intersect` — computes the intersection between two rate masks

## Synopsis

```
unsigned int snd_pcm_rate_mask_intersect (unsigned int rates_a, unsigned
int rates_b);
```

## Arguments

*rates\_a*    The first rate mask

*rates\_b*    The second rate mask

## Description

This function computes the rates that are supported by both rate masks passed to the function. It will take care of the special handling of `SNDRV_PCM_RATE_CONTINUOUS` and `SNDRV_PCM_RATE_KNOT`.

## Return

A rate mask containing the rates that are supported by both *rates\_a* and *rates\_b*.

## Name

`snd_pcm_rate_range_to_bits` — converts rate range to `SNDRV_PCM_RATE_XXX` bit

## Synopsis

```
unsigned int snd_pcm_rate_range_to_bits (unsigned int rate_min, unsigned
int rate_max);
```

## Arguments

*rate\_min* the minimum sample rate

*rate\_max* the maximum sample rate

## Description

This function has an implicit assumption: the rates in the given range have only the pre-defined rates like 44100 or 16000.

## Return

The `SNDRV_PCM_RATE_XXX` flag that corresponds to the given rate range, or `SNDRV_PCM_RATE_KNOT` for an unknown range.

# PCM Memory Management

## Name

`snd_pcm_lib_preallocate_free_for_all` — release all pre-allocated buffers on the pcm

## Synopsis

```
int snd_pcm_lib_preallocate_free_for_all (struct snd_pcm * pcm);
```

## Arguments

*pcm* the pcm instance

## Description

Releases all the pre-allocated buffers on the given pcm.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_lib_preallocate_pages` — pre-allocation for the given DMA type

## Synopsis

```
int snd_pcm_lib_preallocate_pages (struct snd_pcm_substream * sub-  
stream, int type, struct device * data, size_t size, size_t max);
```

## Arguments

|                  |                                            |
|------------------|--------------------------------------------|
| <i>substream</i> | the pcm substream instance                 |
| <i>type</i>      | DMA type (SNDRV_DMA_TYPE_*)                |
| <i>data</i>      | DMA type dependent data                    |
| <i>size</i>      | the requested pre-allocation size in bytes |
| <i>max</i>       | the max. allowed pre-allocation size       |

## Description

Do pre-allocation for the given DMA buffer type.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_lib_preallocate_pages_for_all` — pre-allocation for continuous memory type (all substreams)

## Synopsis

```
int snd_pcm_lib_preallocate_pages_for_all (struct snd_pcm * pcm, int
type, void * data, size_t size, size_t max);
```

## Arguments

*pcm*    the pcm instance

*type*   DMA type (SNDRV\_DMA\_TYPE\_\*)

*data*   DMA type dependent data

*size*   the requested pre-allocation size in bytes

*max*    the max. allowed pre-allocation size

## Description

Do pre-allocation to all substreams of the given pcm for the specified DMA type.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_sgbuf_ops_page` — get the page struct at the given offset

## Synopsis

```
struct page * snd_pcm_sgbuf_ops_page (struct snd_pcm_substream * sub-  
stream, unsigned long offset);
```

## Arguments

*substream*    the pcm substream instance

*offset*        the buffer offset

## Description

Used as the page callback of PCM ops.

## Return

The page struct at the given buffer offset. NULL on failure.

## Name

`snd_pcm_lib_malloc_pages` — allocate the DMA buffer

## Synopsis

```
int snd_pcm_lib_malloc_pages (struct snd_pcm_substream * substream,
size_t size);
```

## Arguments

*substream* the substream to allocate the DMA buffer to

*size* the requested buffer size in bytes

## Description

Allocates the DMA buffer on the BUS type given earlier to `snd_pcm_lib_preallocate_XXX_pages`.

## Return

1 if the buffer is changed, 0 if not changed, or a negative code on failure.

## Name

`snd_pcm_lib_free_pages` — release the allocated DMA buffer.

## Synopsis

```
int snd_pcm_lib_free_pages (struct snd_pcm_substream * substream);
```

## Arguments

*substream* the substream to release the DMA buffer

## Description

Releases the DMA buffer allocated via `snd_pcm_lib_malloc_pages`.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_lib_free_vmalloc_buffer` — free vmalloc buffer

## Synopsis

```
int snd_pcm_lib_free_vmalloc_buffer (struct snd_pcm_substream * sub-  
stream);
```

## Arguments

*substream* the substream with a buffer allocated by `snd_pcm_lib_alloc_vmalloc_buffer`

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_pcm_lib_get_vmalloc_page` — map vmalloc buffer offset to page struct

## Synopsis

```
struct page * snd_pcm_lib_get_vmalloc_page (struct snd_pcm_substream *  
substream, unsigned long offset);
```

## Arguments

*substream*    the substream with a buffer allocated by `snd_pcm_lib_alloc_vmalloc_buffer`

*offset*        offset in the buffer

## Description

This function is to be used as the page callback in the PCM ops.

## Return

The page struct, or NULL on failure.

# PCM DMA Engine API

## Name

`snd_hwparams_to_dma_slave_config` — Convert `hw_params` to `dma_slave_config`

## Synopsis

```
int snd_hwparams_to_dma_slave_config (const struct snd_pcm_substream
* substream, const struct snd_pcm_hw_params * params, struct
dma_slave_config * slave_config);
```

## Arguments

|                     |                  |
|---------------------|------------------|
| <i>substream</i>    | PCM substream    |
| <i>params</i>       | hw_params        |
| <i>slave_config</i> | DMA slave config |

## Description

This function can be used to initialize a `dma_slave_config` from a substream and `hw_params` in a dmaengine based PCM driver implementation.

## Name

`snd_dmaengine_pcm_set_config_from_dai_data` — Initializes a dma slave config using DAI DMA data.

## Synopsis

```
void      snd_dmaengine_pcm_set_config_from_dai_data    (const struct
snd_pcm_substream * substream, const struct snd_dmaengine_dai_dma_data
* dma_data, struct dma_slave_config * slave_config);
```

## Arguments

|                     |                         |
|---------------------|-------------------------|
| <i>substream</i>    | PCM substream           |
| <i>dma_data</i>     | DAI DMA data            |
| <i>slave_config</i> | DMA slave configuration |

## Description

Initializes the `{dst,src}_addr`, `{dst,src}_maxburst`, `{dst,src}_addr_width` and `slave_id` fields of the DMA slave config from the same fields of the DAI DMA data struct. The `src` and `dst` fields will be initialized depending on the direction of the substream. If the substream is a playback stream the `dst` fields will be initialized, if it is a capture stream the `src` fields will be initialized. The `{dst,src}_addr_width` field will only be initialized if the `SND_DMAENGINE_PCM_DAI_FLAG_PACK` flag is set or if the `addr_width` field of the DAI DMA data struct is not equal to `DMA_SLAVE_BUSWIDTH_UNDEFINED`. If both conditions are met the latter takes priority.

## Name

`snd_dmaengine_pcm_trigger` — dmaengine based PCM trigger implementation

## Synopsis

```
int snd_dmaengine_pcm_trigger (struct snd_pcm_substream * substream,
int cmd);
```

## Arguments

*substream*    PCM substream

*cmd*            Trigger command

## Description

Returns 0 on success, a negative error code otherwise.

This function can be used as the PCM trigger callback for dmaengine based PCM driver implementations.

## Name

`snd_dmaengine_pcm_pointer_no_residue` — dmaengine based PCM pointer implementation

## Synopsis

```
snd_pcm_uframes_t      snd_dmaengine_pcm_pointer_no_residue      (struct  
snd_pcm_substream * substream);
```

## Arguments

*substream* PCM substream

## Description

This function is deprecated and should not be used by new drivers, as its results may be unreliable.

## Name

`snd_dmaengine_pcm_pointer` — dmaengine based PCM pointer implementation

## Synopsis

```
snd_pcm_uframes_t snd_dmaengine_pcm_pointer (struct snd_pcm_substream  
* substream);
```

## Arguments

*substream*   PCM substream

## Description

This function can be used as the PCM pointer callback for dmaengine based PCM driver implementations.

## Name

`snd_dmaengine_pcm_request_channel` — Request channel for the dmaengine PCM

## Synopsis

```
struct dma_chan * snd_dmaengine_pcm_request_channel (dma_filter_fn  
filter_fn, void * filter_data);
```

## Arguments

*filter\_fn*      Filter function used to request the DMA channel

*filter\_data*   Data passed to the DMA filter function

## Description

Returns NULL or the requested DMA channel.

This function request a DMA channel for usage with dmaengine PCM.

## Name

`snd_dmaengine_pcm_open` — Open a dmaengine based PCM substream

## Synopsis

```
int snd_dmaengine_pcm_open (struct snd_pcm_substream * substream, struct  
dma_chan * chan);
```

## Arguments

*substream*    PCM substream

*chan*            DMA channel to use for data transfers

## Description

Returns 0 on success, a negative error code otherwise.

The function should usually be called from the pcm open callback. Note that this function will use `private_data` field of the substream's runtime. So it is not available to your pcm driver implementation.

## Name

`snd_dmaengine_pcm_open_request_chan` — Open a dmaengine based PCM substream and request channel

## Synopsis

```
int snd_dmaengine_pcm_open_request_chan (struct snd_pcm_substream *  
substream, dma_filter_fn filter_fn, void * filter_data);
```

## Arguments

*substream*     PCM substream

*filter\_fn*     Filter function used to request the DMA channel

*filter\_data*   Data passed to the DMA filter function

## Description

Returns 0 on success, a negative error code otherwise.

This function will request a DMA channel using the passed filter function and data. The function should usually be called from the pcm open callback. Note that this function will use `private_data` field of the substream's runtime. So it is not available to your pcm driver implementation.

## Name

`snd_dmaengine_pcm_close` — Close a dmaengine based PCM substream

## Synopsis

```
int snd_dmaengine_pcm_close (struct snd_pcm_substream * substream);
```

## Arguments

*substream*   PCM substream

## Name

`snd_dmaengine_pcm_close_release_chan` — Close a dmaengine based PCM substream and release channel

## Synopsis

```
int snd_dmaengine_pcm_close_release_chan (struct snd_pcm_substream *  
substream);
```

## Arguments

*substream* PCM substream

## Description

Releases the DMA channel associated with the PCM substream.

## Name

`snd_pcm_substream_to_dma_direction` — Get `dma_transfer_direction` for a PCM substream

## Synopsis

```
enum dma_transfer_direction snd_pcm_substream_to_dma_direction (const  
struct snd_pcm_substream * substream);
```

## Arguments

*substream*   PCM substream

## Name

struct snd\_dmaengine\_dai\_dma\_data — DAI DMA configuration data

## Synopsis

```
struct snd_dmaengine_dai_dma_data {
    dma_addr_t addr;
    enum dma_slave_buswidth addr_width;
    u32 maxburst;
    unsigned int slave_id;
    void * filter_data;
    const char * chan_name;
    unsigned int fifo_size;
    unsigned int flags;
};
```

## Members

|             |                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| addr        | Address of the DAI data source or destination register.                                                                                              |
| addr_width  | Width of the DAI data source or destination register.                                                                                                |
| maxburst    | Maximum number of words(note: words, as in units of the src_addr_width member, not bytes) that can be send to or received from the DAI in one burst. |
| slave_id    | Slave requester id for the DMA channel.                                                                                                              |
| filter_data | Custom DMA channel filter data, this will usually be used when requesting the DMA channel.                                                           |
| chan_name   | Custom channel name to use when requesting DMA channel.                                                                                              |
| fifo_size   | FIFO size of the DAI controller in bytes                                                                                                             |
| flags       | PCM_DAI flags, only SND_DMAENGINE_PCM_DAI_FLAG_PACK for now                                                                                          |

## Name

struct snd\_dmaengine\_pcm\_config — Configuration data for dmaengine based PCM

## Synopsis

```
struct snd_dmaengine_pcm_config {
    int (* prepare_slave_config) (struct snd_pcm_substream *substream, struct snd_pcm_hw_params *hparams);
    struct dma_chan *(* compat_request_channel) (struct snd_soc_pcm_runtime *rtd, struct snd_pcm_hw_params *hparams);
    dma_filter_fn compat_filter_fn;
    struct device * dma_dev;
    const char * chan_names[SNDRV_PCM_STREAM_LAST + 1];
    const struct snd_pcm_hardware * pcm_hardware;
    unsigned int prealloc_buffer_size;
};
```

## Members

|                                       |                                                                                                                                                           |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| prepare_slave_config                  | Callback used to fill in the DMA slave_config for a PCM substream. Will be called from the PCM drivers hwparams callback.                                 |
| compat_request_channel                | Callback to request a DMA channel for platforms which do not use devicetree.                                                                              |
| compat_filter_fn                      | Will be used as the filter function when requesting a channel for platforms which do not use devicetree. The filter parameter will be the DAI's DMA data. |
| dma_dev                               | If set, request DMA channel on this device rather than the DAI device.                                                                                    |
| chan_names[SNDRV_PCM_STREAM_LAST + 1] | If set, these custom DMA channel names will be requested at registration time.                                                                            |
| pcm_hardware                          | snd_pcm_hardware struct to be used for the PCM.                                                                                                           |
| prealloc_buffer_size                  | Size of the preallocated audio buffer.                                                                                                                    |

## Note

If both compat\_request\_channel and compat\_filter\_fn are set compat\_request\_channel will be used to request the channel and compat\_filter\_fn will be ignored. Otherwise the channel will be requested using dma\_request\_channel with compat\_filter\_fn as the filter function.

---

# **Chapter 3. Control/Mixer API**

## **General Control Interface**

## Name

`snd_ctl_notify` — Send notification to user-space for a control change

## Synopsis

```
void snd_ctl_notify (struct snd_card * card, unsigned int mask, struct  
snd_ctl_elem_id * id);
```

## Arguments

*card* the card to send notification

*mask* the event mask, `SNDRV_CTL_EVENT_*`

*id* the ctl element id to send notification

## Description

This function adds an event record with the given id and mask, appends to the list and wakes up the user-space for notification. This can be called in the atomic context.

## Name

`snd_ctl_new1` — create a control instance from the template

## Synopsis

```
struct snd_kcontrol * snd_ctl_new1 (const struct snd_kcontrol_new *  
ncontrol, void * private_data);
```

## Arguments

*ncontrol*            the initialization record

*private\_data*    the private data to set

## Description

Allocates a new struct `snd_kcontrol` instance and initialize from the given template. When the access field of `ncontrol` is 0, it's assumed as `READWRITE` access. When the count field is 0, it's assumes as one.

## Return

The pointer of the newly generated instance, or `NULL` on failure.

## Name

`snd_ctl_free_one` — release the control instance

## Synopsis

```
void snd_ctl_free_one (struct snd_kcontrol * kcontrol);
```

## Arguments

*kcontrol* the control instance

## Description

Releases the control instance created via `snd_ctl_new` or `snd_ctl_new1`. Don't call this after the control was added to the card.

## Name

`snd_ctl_add` — add the control instance to the card

## Synopsis

```
int snd_ctl_add (struct snd_card * card, struct snd_kcontrol * kcontrol);
```

## Arguments

*card*            the card instance

*kcontrol*       the control instance to add

## Description

Adds the control instance created via `snd_ctl_new` or `snd_ctl_new1` to the given card. Assigns also an unique numid used for fast search.

It frees automatically the control which cannot be added.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_ctl_replace` — replace the control instance of the card

## Synopsis

```
int snd_ctl_replace (struct snd_card * card, struct snd_kcontrol *  
kcontrol, bool add_on_replace);
```

## Arguments

|                       |                                      |
|-----------------------|--------------------------------------|
| <i>card</i>           | the card instance                    |
| <i>kcontrol</i>       | the control instance to replace      |
| <i>add_on_replace</i> | add the control if not already added |

## Description

Replaces the given control. If the given control does not exist and the `add_on_replace` flag is set, the control is added. If the control exists, it is destroyed first.

It frees automatically the control which cannot be added or replaced.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_ctl_remove` — remove the control from the card and release it

## Synopsis

```
int snd_ctl_remove (struct snd_card * card, struct snd_kcontrol * kcontrol);
```

## Arguments

*card*            the card instance

*kcontrol*       the control instance to remove

## Description

Removes the control from the card and then releases the instance. You don't need to call `snd_ctl_free_one`. You must be in the write lock - `down_write(card->controls_rwsem)`.

## Return

0 if successful, or a negative error code on failure.

## Name

`snd_ctl_remove_id` — remove the control of the given id and release it

## Synopsis

```
int snd_ctl_remove_id (struct snd_card * card, struct snd_ctl_elem_id  
* id);
```

## Arguments

*card*    the card instance

*id*       the control id to remove

## Description

Finds the control instance with the given id, removes it from the card list and releases it.

## Return

0 if successful, or a negative error code on failure.

## Name

`snd_ctl_activate_id` — activate/inactivate the control of the given id

## Synopsis

```
int snd_ctl_activate_id (struct snd_card * card, struct snd_ctl_elem_id  
* id, int active);
```

## Arguments

*card*      the card instance

*id*        the control id to activate/inactivate

*active*    non-zero to activate

## Description

Finds the control instance with the given id, and activate or inactivate the control together with notification, if changed. The given ID data is filled with full information.

## Return

0 if unchanged, 1 if changed, or a negative error code on failure.

## Name

`snd_ctl_rename_id` — replace the id of a control on the card

## Synopsis

```
int snd_ctl_rename_id (struct snd_card * card, struct snd_ctl_elem_id  
* src_id, struct snd_ctl_elem_id * dst_id);
```

## Arguments

*card*      the card instance

*src\_id*    the old id

*dst\_id*    the new id

## Description

Finds the control with the old id from the card, and replaces the id with the new one.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_ctl_find_numid` — find the control instance with the given number-id

## Synopsis

```
struct snd_kcontrol * snd_ctl_find_numid (struct snd_card * card, unsigned int numid);
```

## Arguments

*card*    the card instance

*numid*   the number-id to search

## Description

Finds the control instance with the given number-id from the card.

The caller must down `card->controls_rwsem` before calling this function (if the race condition can happen).

## Return

The pointer of the instance if found, or NULL if not.

## Name

`snd_ctl_find_id` — find the control instance with the given id

## Synopsis

```
struct snd_kcontrol * snd_ctl_find_id (struct snd_card * card, struct  
snd_ctl_elem_id * id);
```

## Arguments

*card* the card instance

*id* the id to search

## Description

Finds the control instance with the given id from the card.

The caller must down `card->controls_rwsem` before calling this function (if the race condition can happen).

## Return

The pointer of the instance if found, or NULL if not.

## Name

`snd_ctl_register_ioctl` — register the device-specific control-ioctl

## Synopsis

```
int snd_ctl_register_ioctl (snd_kctl_ioctl_func_t fcn);
```

## Arguments

*fcn*    ioctl callback function

## Description

called from each device manager like pcm.c, hwdep.c, etc.

## Name

`snd_ctl_register_ioctl_compat` — register the device-specific 32bit compat control-ioctl

## Synopsis

```
int snd_ctl_register_ioctl_compat (snd_kctl_ioctl_func_t fcn);
```

## Arguments

*fcn*    ioctl callback function

## Name

`snd_ctl_unregister_ioctl` — de-register the device-specific control-ioctls

## Synopsis

```
int snd_ctl_unregister_ioctl (snd_kctl_ioctl_func_t fcn);
```

## Arguments

*fcn*    ioctl callback function to unregister

## Name

`snd_ctl_unregister_ioctl_compat` — de-register the device-specific compat 32bit control-iocls

## Synopsis

```
int snd_ctl_unregister_ioctl_compat (snd_kctl_ioctl_func_t fcn);
```

## Arguments

*fcn*    ioctl callback function to unregister

## Name

`snd_ctl_boolean_mono_info` — Helper function for a standard boolean info callback with a mono channel

## Synopsis

```
int snd_ctl_boolean_mono_info (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_info * uinfo);
```

## Arguments

*kcontrol*    the kcontrol instance

*uinfo*       info to store

## Description

This is a function that can be used as info callback for a standard boolean control with a single mono channel.

## Name

`snd_ctl_boolean_stereo_info` — Helper function for a standard boolean info callback with stereo two channels

## Synopsis

```
int snd_ctl_boolean_stereo_info (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_info * uinfo);
```

## Arguments

*kcontrol*    the kcontrol instance

*uinfo*       info to store

## Description

This is a function that can be used as info callback for a standard boolean control with stereo two channels.

## Name

`snd_ctl_enum_info` — fills the info structure for an enumerated control

## Synopsis

```
int snd_ctl_enum_info (struct snd_ctl_elem_info * info, unsigned int
channels, unsigned int items, const char *const names[]);
```

## Arguments

|                 |                                                             |
|-----------------|-------------------------------------------------------------|
| <i>info</i>     | the structure to be filled                                  |
| <i>channels</i> | the number of the control's channels; often one             |
| <i>items</i>    | the number of control values; also the size of <i>names</i> |
| <i>names</i> [] | an array containing the names of all control values         |

## Description

Sets all required fields in *info* to their appropriate values. If the control's accessibility is not the default (readable and writable), the caller has to fill *info*->access.

## Return

Zero.

# AC97 Codec API

## Name

`snd_ac97_write` — write a value on the given register

## Synopsis

```
void snd_ac97_write (struct snd_ac97 * ac97, unsigned short reg, unsigned short value);
```

## Arguments

*ac97*    the ac97 instance

*reg*    the register to change

*value*   the value to set

## Description

Writes a value on the given register. This will invoke the write callback directly after the register check. This function doesn't change the register cache unlike `#snd_ca97_write_cache`, so use this only when you don't want to reflect the change to the suspend/resume state.

## Name

`snd_ac97_read` — read a value from the given register

## Synopsis

```
unsigned short snd_ac97_read (struct snd_ac97 * ac97, unsigned short  
reg);
```

## Arguments

*ac97*    the ac97 instance

*reg*    the register to read

## Description

Reads a value from the given register. This will invoke the read callback directly after the register check.

## Return

The read value.

## Name

`snd_ac97_write_cache` — write a value on the given register and update the cache

## Synopsis

```
void snd_ac97_write_cache (struct snd_ac97 * ac97, unsigned short reg,  
unsigned short value);
```

## Arguments

*ac97*    the ac97 instance

*reg*    the register to change

*value*   the value to set

## Description

Writes a value on the given register and updates the register cache. The cached values are used for the cached-read and the suspend/resume.

## Name

`snd_ac97_update` — update the value on the given register

## Synopsis

```
int snd_ac97_update (struct snd_ac97 * ac97, unsigned short reg, unsigned short value);
```

## Arguments

*ac97*    the ac97 instance

*reg*    the register to change

*value*   the value to set

## Description

Compares the value with the register cache and updates the value only when the value is changed.

## Return

1 if the value is changed, 0 if no change, or a negative code on failure.

## Name

`snd_ac97_update_bits` — update the bits on the given register

## Synopsis

```
int snd_ac97_update_bits (struct snd_ac97 * ac97, unsigned short reg,  
unsigned short mask, unsigned short value);
```

## Arguments

*ac97*    the ac97 instance

*reg*     the register to change

*mask*    the bit-mask to change

*value*   the value to set

## Description

Updates the masked-bits on the given register only when the value is changed.

## Return

1 if the bits are changed, 0 if no change, or a negative code on failure.

## Name

`snd_ac97_get_short_name` — retrieve codec name

## Synopsis

```
const char * snd_ac97_get_short_name (struct snd_ac97 * ac97);
```

## Arguments

*ac97* the codec instance

## Return

The short identifying name of the codec.

## Name

`snd_ac97_bus` — create an AC97 bus component

## Synopsis

```
int  snd_ac97_bus (struct snd_card * card, int num, struct
snd_ac97_bus_ops * ops, void * private_data, struct snd_ac97_bus **
rbus);
```

## Arguments

|                     |                                                 |
|---------------------|-------------------------------------------------|
| <i>card</i>         | the card instance                               |
| <i>num</i>          | the bus number                                  |
| <i>ops</i>          | the bus callbacks table                         |
| <i>private_data</i> | private data pointer for the new instance       |
| <i>rbus</i>         | the pointer to store the new AC97 bus instance. |

## Description

Creates an AC97 bus component. An struct `snd_ac97_bus` instance is newly allocated and initialized.

The ops table must include valid callbacks (at least read and write). The other callbacks, wait and reset, are not mandatory.

The clock is set to 48000. If another clock is needed, set `(*rbus)->clock` manually.

The AC97 bus instance is registered as a low-level device, so you don't have to release it manually.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_ac97_mixer` — create an Codec97 component

## Synopsis

```
int snd_ac97_mixer (struct snd_ac97_bus * bus, struct snd_ac97_template  
* template, struct snd_ac97 ** rac97);
```

## Arguments

*bus*            the AC97 bus which codec is attached to

*template*    the template of ac97, including index, callbacks and the private data.

*rac97*        the pointer to store the new ac97 instance.

## Description

Creates an Codec97 component. An struct `snd_ac97` instance is newly allocated and initialized from the template. The codec is then initialized by the standard procedure.

The template must include the codec number (`num`) and address (`addr`), and the private data (`private_data`).

The ac97 instance is registered as a low-level device, so you don't have to release it manually.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_ac97_update_power` — update the powerdown register

## Synopsis

```
int snd_ac97_update_power (struct snd_ac97 * ac97, int reg, int powerup);
```

## Arguments

*ac97*        the codec instance

*reg*        the rate register, e.g. `AC97_PCM_FRONT_DAC_RATE`

*powerup*   non-zero when power up the part

## Description

Update the AC97 powerdown register bits of the given part.

## Return

Zero.

## Name

`snd_ac97_suspend` — General suspend function for AC97 codec

## Synopsis

```
void snd_ac97_suspend (struct snd_ac97 * ac97);
```

## Arguments

*ac97* the ac97 instance

## Description

Suspends the codec, power down the chip.

## Name

`snd_ac97_resume` — General resume function for AC97 codec

## Synopsis

```
void snd_ac97_resume (struct snd_ac97 * ac97);
```

## Arguments

*ac97* the ac97 instance

## Description

Do the standard resume procedure, power up and restoring the old register values.

## Name

`snd_ac97_tune_hardware` — tune up the hardware

## Synopsis

```
int snd_ac97_tune_hardware (struct snd_ac97 * ac97, const struct  
ac97_quirk * quirk, const char * override);
```

## Arguments

*ac97*            the ac97 instance

*quirk*          quirk list

*override*      explicit quirk value (overrides the list if non-NULL)

## Description

Do some workaround for each pci device, such as renaming of the headphone (true line-out) control as “Master”. The quirk-list must be terminated with a zero-filled entry.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_ac97_set_rate` — change the rate of the given input/output.

## Synopsis

```
int snd_ac97_set_rate (struct snd_ac97 * ac97, int reg, unsigned int rate);
```

## Arguments

*ac97* the ac97 instance

*reg* the register to change

*rate* the sample rate to set

## Description

Changes the rate of the given input/output on the codec. If the codec doesn't support VAR, the rate must be 48000 (except for SPDIF).

The valid registers are `AC97_PMC_MIC_ADC_RATE`, `AC97_PCM_FRONT_DAC_RATE`, `AC97_PCM_LR_ADC_RATE`, `AC97_PCM_SURR_DAC_RATE` and `AC97_PCM_LFE_DAC_RATE` are accepted if the codec supports them. `AC97_SPDIF` is accepted as a pseudo register to modify the SPDIF status bits.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_ac97_pcm_assign` — assign AC97 slots to given PCM streams

## Synopsis

```
int snd_ac97_pcm_assign (struct snd_ac97_bus * bus, unsigned short
pcms_count, const struct ac97_pcm * pcms);
```

## Arguments

|                   |                              |
|-------------------|------------------------------|
| <i>bus</i>        | the ac97 bus instance        |
| <i>pcms_count</i> | count of PCMs to be assigned |
| <i>pcms</i>       | PCMs to be assigned          |

## Description

It assigns available AC97 slots for given PCMs. If none or only some slots are available, `pcm->xxx.slots` and `pcm->xxx.rslots[]` members are reduced and might be zero.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_ac97_pcm_open` — opens the given AC97 pcm

## Synopsis

```
int snd_ac97_pcm_open (struct ac97_pcm * pcm, unsigned int rate, enum  
ac97_pcm_cfg cfg, unsigned short slots);
```

## Arguments

*pcm*      the ac97 pcm instance

*rate*     rate in Hz, if codec does not support VRA, this value must be 48000Hz

*cfg*      output stream characteristics

*slots*    a subset of allocated slots (`snd_ac97_pcm_assign`) for this pcm

## Description

It locks the specified slots and sets the given rate to AC97 registers.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_ac97_pcm_close` — closes the given AC97 pcm

## Synopsis

```
int snd_ac97_pcm_close (struct ac97_pcm * pcm);
```

## Arguments

*pcm* the ac97 pcm instance

## Description

It frees the locked AC97 slots.

## Return

Zero.

## Name

`snd_ac97_pcm_double_rate_rules` — set double rate constraints

## Synopsis

```
int snd_ac97_pcm_double_rate_rules (struct snd_pcm_runtime * runtime);
```

## Arguments

*runtime* the runtime of the ac97 front playback pcm

## Description

Installs the hardware constraint rules to prevent using double rates and more than two channels at the same time.

## Return

Zero if successful, or a negative error code on failure.

# Virtual Master Control API

## Name

`snd_ctl_make_virtual_master` — Create a virtual master control

## Synopsis

```
struct snd_kcontrol * snd_ctl_make_virtual_master (char * name, const
unsigned int * tlv);
```

## Arguments

*name*    name string of the control element to create

*tlv*     optional TLV int array for dB information

## Description

Creates a virtual master control with the given name string.

After creating a vmaster element, you can add the slave controls via `snd_ctl_add_slave` or `snd_ctl_add_slave_uncached`.

The optional argument *tlv* can be used to specify the TLV information for dB scale of the master control. It should be a single element with `#SNDRV_CTL_TLVT_DB_SCALE`, `#SNDRV_CTL_TLV_DB_MINMAX` or `#SNDRV_CTL_TLVT_DB_MINMAX_MUTE` type, and should be the max 0dB.

## Return

The created control element, or `NULL` for errors (`ENOMEM`).

## Name

`snd_ctl_add_vmaster_hook` — Add a hook to a vmaster control

## Synopsis

```
int snd_ctl_add_vmaster_hook (struct snd_kcontrol * kcontrol, void
(*hook) (void *private_data, int), void * private_data);
```

## Arguments

*kcontrol*            vmaster kctl element

*hook*                the hook function

*private\_data*    the private\_data pointer to be saved

## Description

Adds the given hook to the vmaster control element so that it's called at each time when the value is changed.

## Return

Zero.

## Name

`snd_ctl_sync_vmaster` — Sync the vmaster slaves and hook

## Synopsis

```
void snd_ctl_sync_vmaster (struct snd_kcontrol * kcontrol, bool  
hook_only);
```

## Arguments

*kcontrol*    vmaster kctl element

*hook\_only*   sync only the hook

## Description

Forcibly call the put callback of each slave and call the hook function to synchronize with the current value of the given vmaster element. NOP when NULL is passed to *kcontrol*.

## Name

`snd_ctl_add_slave` — Add a virtual slave control

## Synopsis

```
int snd_ctl_add_slave (struct snd_kcontrol * master, struct snd_kcontrol  
* slave);
```

## Arguments

*master*    vmaster element

*slave*     slave element to add

## Description

Add a virtual slave control to the given master element created via `snd_ctl_create_virtual_master` beforehand.

All slaves must be the same type (returning the same information via info callback). The function doesn't check it, so it's your responsibility.

Also, some additional limitations: at most two channels, logarithmic volume control (dB level) thus no linear volume, master can only attenuate the volume without gain

## Return

Zero if successful or a negative error code.

## Name

`snd_ctl_add_slave_uncached` — Add a virtual slave control

## Synopsis

```
int snd_ctl_add_slave_uncached (struct snd_kcontrol * master, struct
snd_kcontrol * slave);
```

## Arguments

*master*    vmaster element

*slave*     slave element to add

## Description

Add a virtual slave control to the given master. Unlike `snd_ctl_add_slave`, the element added via this function is supposed to have volatile values, and get callback is called at each time queried from the master.

When the control peeks the hardware values directly and the value can be changed by other means than the put callback of the element, this function should be used to keep the value always up-to-date.

## Return

Zero if successful or a negative error code.

---

# Chapter 4. MIDI API

## Raw MIDI API

## Name

`snd_rawmidi_receive` — receive the input data from the device

## Synopsis

```
int snd_rawmidi_receive (struct snd_rawmidi_substream * substream, const
unsigned char * buffer, int count);
```

## Arguments

*substream*    the rawmidi substream

*buffer*       the buffer pointer

*count*        the data size to read

## Description

Reads the data from the internal buffer.

## Return

The size of read data, or a negative error code on failure.

## Name

`snd_rawmidi_transmit_empty` — check whether the output buffer is empty

## Synopsis

```
int snd_rawmidi_transmit_empty (struct snd_rawmidi_substream * sub-  
stream);
```

## Arguments

*substream* the rawmidi substream

## Return

1 if the internal output buffer is empty, 0 if not.

## Name

`__snd_rawmidi_transmit_peek` — copy data from the internal buffer

## Synopsis

```
int __snd_rawmidi_transmit_peek (struct snd_rawmidi_substream * sub-  
stream, unsigned char * buffer, int count);
```

## Arguments

*substream*    the rawmidi substream

*buffer*       the buffer pointer

*count*        data size to transfer

## Description

This is a variant of `snd_rawmidi_transmit_peek` without spinlock.

## Name

`snd_rawmidi_transmit_peek` — copy data from the internal buffer

## Synopsis

```
int snd_rawmidi_transmit_peek (struct snd_rawmidi_substream * sub-
stream, unsigned char * buffer, int count);
```

## Arguments

*substream*    the rawmidi substream

*buffer*        the buffer pointer

*count*         data size to transfer

## Description

Copies data from the internal output buffer to the given buffer.

Call this in the interrupt handler when the midi output is ready, and call `snd_rawmidi_transmit_ack` after the transmission is finished.

## Return

The size of copied data, or a negative error code on failure.

## Name

`__snd_rawmidi_transmit_ack` — acknowledge the transmission

## Synopsis

```
int __snd_rawmidi_transmit_ack (struct snd_rawmidi_substream * sub-  
stream, int count);
```

## Arguments

*substream*    the rawmidi substream

*count*        the transferred count

## Description

This is a variant of `__snd_rawmidi_transmit_ack` without spinlock.

## Name

`snd_rawmidi_transmit_ack` — acknowledge the transmission

## Synopsis

```
int snd_rawmidi_transmit_ack (struct snd_rawmidi_substream * substream,
int count);
```

## Arguments

*substream*    the rawmidi substream

*count*        the transferred count

## Description

Advances the hardware pointer for the internal output buffer with the given size and updates the condition. Call after the transmission is finished.

## Return

The advanced size if successful, or a negative error code on failure.

## Name

`snd_rawmidi_transmit` — copy from the buffer to the device

## Synopsis

```
int snd_rawmidi_transmit (struct snd_rawmidi_substream * substream, unsigned char * buffer, int count);
```

## Arguments

*substream*    the rawmidi substream

*buffer*       the buffer pointer

*count*        the data size to transfer

## Description

Copies data from the buffer to the device and advances the pointer.

## Return

The copied size if successful, or a negative error code on failure.

## Name

`snd_rawmidi_new` — create a rawmidi instance

## Synopsis

```
int snd_rawmidi_new (struct snd_card * card, char * id, int device, int  
output_count, int input_count, struct snd_rawmidi ** rrawmidi);
```

## Arguments

|                     |                                               |
|---------------------|-----------------------------------------------|
| <i>card</i>         | the card instance                             |
| <i>id</i>           | the id string                                 |
| <i>device</i>       | the device index                              |
| <i>output_count</i> | the number of output streams                  |
| <i>input_count</i>  | the number of input streams                   |
| <i>rrawmidi</i>     | the pointer to store the new rawmidi instance |

## Description

Creates a new rawmidi instance. Use `snd_rawmidi_set_ops` to set the operators to the new instance.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_rawmidi_set_ops` — set the rawmidi operators

## Synopsis

```
void snd_rawmidi_set_ops (struct snd_rawmidi * rmidi, int stream, struct  
snd_rawmidi_ops * ops);
```

## Arguments

*rmidi*    the rawmidi instance

*stream*   the stream direction, `SNDRV_RAWMIDI_STREAM_XXX`

*ops*       the operator table

## Description

Sets the rawmidi operators for the given stream direction.

# MPU401-UART API

## Name

`snd_mpu401_uart_interrupt` — generic MPU401-UART interrupt handler

## Synopsis

```
irqreturn_t snd_mpu401_uart_interrupt (int irq, void * dev_id);
```

## Arguments

*irq*        the irq number  
*dev\_id*    mpu401 instance

## Description

Processes the interrupt for MPU401-UART i/o.

## Return

IRQ\_HANDLED if the interrupt was handled. IRQ\_NONE otherwise.

## Name

`snd_mpu401_uart_interrupt_tx` — generic MPU401-UART transmit irq handler

## Synopsis

```
irqreturn_t snd_mpu401_uart_interrupt_tx (int irq, void * dev_id);
```

## Arguments

*irq*        the irq number  
*dev\_id*    mpu401 instance

## Description

Processes the interrupt for MPU401-UART output.

## Return

IRQ\_HANDLED if the interrupt was handled. IRQ\_NONE otherwise.

## Name

`snd_mpu401_uart_new` — create an MPU401-UART instance

## Synopsis

```
int snd_mpu401_uart_new (struct snd_card * card, int device, unsigned
short hardware, unsigned long port, unsigned int info_flags, int irq,
struct snd_rawmidi ** rrawmidi);
```

## Arguments

|                   |                                               |
|-------------------|-----------------------------------------------|
| <i>card</i>       | the card instance                             |
| <i>device</i>     | the device index, zero-based                  |
| <i>hardware</i>   | the hardware type, MPU401_HW_XXXX             |
| <i>port</i>       | the base address of MPU401 port               |
| <i>info_flags</i> | bitflags MPU401_INFO_XXX                      |
| <i>irq</i>        | the ISA irq number, -1 if not to be allocated |
| <i>rrawmidi</i>   | the pointer to store the new rawmidi instance |

## Description

Creates a new MPU-401 instance.

Note that the rawmidi instance is returned on the `rrawmidi` argument, not the mpu401 instance itself. To access to the mpu401 instance, cast from `rrawmidi->private_data` (with struct `snd_mpu401` magic-cast).

## Return

Zero if successful, or a negative error code.

---

# **Chapter 5. Proc Info API**

## **Proc Info Interface**

## Name

`snd_info_get_line` — read one line from the procfs buffer

## Synopsis

```
int snd_info_get_line (struct snd_info_buffer * buffer, char * line,  
int len);
```

## Arguments

*buffer*    the procfs buffer

*line*      the buffer to store

*len*        the max. buffer size

## Description

Reads one line from the buffer and stores the string.

## Return

Zero if successful, or 1 if error or EOF.

## Name

`snd_info_get_str` — parse a string token

## Synopsis

```
const char * snd_info_get_str (char * dest, const char * src, int len);
```

## Arguments

*dest*    the buffer to store the string token

*src*     the original string

*len*     the max. length of token - 1

## Description

Parses the original string and copy a token to the given string buffer.

## Return

The updated pointer of the original string so that it can be used for the next call.

## Name

`snd_info_create_module_entry` — create an info entry for the given module

## Synopsis

```
struct snd_info_entry * snd_info_create_module_entry (struct module *  
module, const char * name, struct snd_info_entry * parent);
```

## Arguments

*module*    the module pointer

*name*      the file name

*parent*    the parent directory

## Description

Creates a new info entry and assigns it to the given module.

## Return

The pointer of the new instance, or NULL on failure.

## Name

`snd_info_create_card_entry` — create an info entry for the given card

## Synopsis

```
struct snd_info_entry * snd_info_create_card_entry (struct snd_card *  
card, const char * name, struct snd_info_entry * parent);
```

## Arguments

*card*      the card instance

*name*      the file name

*parent*    the parent directory

## Description

Creates a new info entry and assigns it to the given card.

## Return

The pointer of the new instance, or NULL on failure.

## Name

`snd_info_free_entry` — release the info entry

## Synopsis

```
void snd_info_free_entry (struct snd_info_entry * entry);
```

## Arguments

*entry* the info entry

## Description

Releases the info entry.

## Name

`snd_info_register` — register the info entry

## Synopsis

```
int snd_info_register (struct snd_info_entry * entry);
```

## Arguments

*entry* the info entry

## Description

Registers the proc info entry.

## Return

Zero if successful, or a negative error code on failure.

---

# **Chapter 6. Compress Offload**

## **Compress Offload API**

## Name

`snd_compress_register` — register compressed device

## Synopsis

```
int snd_compress_register (struct snd_compr * device);
```

## Arguments

*device*    compressed device to register

## Name

struct snd\_compressed\_buffer — compressed buffer

## Synopsis

```
struct snd_compressed_buffer {  
    __u32 fragment_size;  
    __u32 fragments;  
};
```

## Members

|               |                                  |
|---------------|----------------------------------|
| fragment_size | size of buffer fragment in bytes |
| fragments     | number of such fragments         |

## Name

struct snd\_compr\_params — compressed stream params

## Synopsis

```
struct snd_compr_params {  
    struct snd_compressed_buffer buffer;  
    struct snd_codec codec;  
    __u8 no_wake_mode;  
};
```

## Members

|              |                               |
|--------------|-------------------------------|
| buffer       | buffer description            |
| codec        | codec parameters              |
| no_wake_mode | dont wake on fragment elapsed |

## Name

struct snd\_compr\_tstamp — timestamp descriptor

## Synopsis

```
struct snd_compr_tstamp {
    __u32 byte_offset;
    __u32 copied_total;
    __u32 pcm_frames;
    __u32 pcm_io_frames;
    __u32 sampling_rate;
};
```

## Members

|               |                                                                                                                                                                                   |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| byte_offset   | Byte offset in ring buffer to DSP                                                                                                                                                 |
| copied_total  | Total number of bytes copied from/to ring buffer to/by DSP                                                                                                                        |
| pcm_frames    | Frames decoded or encoded by DSP. This field will evolve by large steps and should only be used to monitor encoding/decoding progress. It shall not be used for timing estimates. |
| pcm_io_frames | Frames rendered or received by DSP into a mixer or an audio output/input. This field should be used for A/V sync or time estimates.                                               |
| sampling_rate | sampling rate of audio                                                                                                                                                            |

## Name

struct snd\_compr\_avail — avail descriptor

## Synopsis

```
struct snd_compr_avail {  
    __u64 avail;  
    struct snd_compr_tstamp tstamp;  
};
```

## Members

|        |                                                              |
|--------|--------------------------------------------------------------|
| avail  | Number of bytes available in ring buffer for writing/reading |
| tstamp | timestamp information                                        |

## Name

struct snd\_compr\_caps — caps descriptor

## Synopsis

```
struct snd_compr_caps {
    __u32 num_codecs;
    __u32 direction;
    __u32 min_fragment_size;
    __u32 max_fragment_size;
    __u32 min_fragments;
    __u32 max_fragments;
    __u32 codecs[MAX_NUM_CODECS];
    __u32 reserved[11];
};
```

## Members

|                        |                                                  |
|------------------------|--------------------------------------------------|
| num_codecs             | number of codecs supported                       |
| direction              | direction supported. Of type snd_compr_direction |
| min_fragment_size      | minimum fragment supported by DSP                |
| max_fragment_size      | maximum fragment supported by DSP                |
| min_fragments          | min fragments supported by DSP                   |
| max_fragments          | max fragments supported by DSP                   |
| codecs[MAX_NUM_CODECS] | pointer to array of codecs                       |
| reserved[11]           | reserved field                                   |

## Name

struct snd\_compr\_codec\_caps — query capability of codec

## Synopsis

```
struct snd_compr_codec_caps {  
    __u32 codec;  
    __u32 num_descriptors;  
    struct snd_codec_desc descriptor[MAX_NUM_CODEC_DESCRIPTORS];  
};
```

## Members

|                                       |                                       |
|---------------------------------------|---------------------------------------|
| codec                                 | codec for which capability is queried |
| num_descriptors                       | number of codec descriptors           |
| descriptor[MAX_NUM_CODEC_DESCRIPTORS] | array of capability descriptors       |

## Name

enum sndrv\_compress\_encoder —

## Synopsis

```
enum sndrv_compress_encoder {  
    SNDRV_COMPRESS_ENCODER_PADDING,  
    SNDRV_COMPRESS_ENCODER_DELAY  
};
```

## Constants

SNDRV\_COMPRESS\_ENCODER\_PADDING: Samples appended by the encoder at the end of the track

SNDRV\_COMPRESS\_ENCODER\_DELAY: Samples inserted by the encoder at the beginning of the track

## Name

struct snd\_compr\_metadata — compressed stream metadata

## Synopsis

```
struct snd_compr_metadata {  
    __u32 key;  
    __u32 value[8];  
};
```

## Members

|          |           |
|----------|-----------|
| key      | key id    |
| value[8] | key value |

## Name

`SNDRV_COMPRESS_IOCTL_VERSION` —

## Synopsis

```
SNDRV_COMPRESS_IOCTL_VERSION (void);
```

## Arguments

None

## Description

`SNDRV_COMPRESS_GET_CAPS`: Query capability of DSP  
`SNDRV_COMPRESS_GET_CODEC_CAPS`: Query capability of a codec  
`SNDRV_COMPRESS_SET_PARAMS`: Set codec and stream parameters

## Note

only codec params can be changed runtime and stream params cant be  
`SNDRV_COMPRESS_GET_PARAMS`: Query codec params  
`SNDRV_COMPRESS_TSTAMP`: get the current timestamp value  
`SNDRV_COMPRESS_AVAIL`: get the current buffer avail value.  
This also queries the tstamp properties  
`SNDRV_COMPRESS_PAUSE`: Pause the running stream  
`SNDRV_COMPRESS_RESUME`: resume a paused stream  
`SNDRV_COMPRESS_START`: Start a stream  
`SNDRV_COMPRESS_STOP`: stop a running stream, discarding ring buffer content and the buffers currently with DSP  
`SNDRV_COMPRESS_DRAIN`: Play till end of buffers and stop after that  
`SNDRV_COMPRESS_IOCTL_VERSION`: Query the API version

## Name

struct snd\_enc\_vorbis —

## Synopsis

```
struct snd_enc_vorbis {
    __s32 quality;
    __u32 managed;
    __u32 max_bit_rate;
    __u32 min_bit_rate;
    __u32 downmix;
};
```

## Members

|              |                                                                                                                                                                                                                                                        |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| quality      | Sets encoding quality to n, between -1 (low) and 10 (high). In the default mode of operation, the quality level is 3. Normal quality range is 0 - 10.                                                                                                  |
| managed      | Boolean. Set bitrate management mode. This turns off the normal VBR encoding, but allows hard or soft bitrate constraints to be enforced by the encoder. This mode can be slower, and may also be lower quality. It is primarily useful for streaming. |
| max_bit_rate | Enabled only if managed is TRUE                                                                                                                                                                                                                        |
| min_bit_rate | Enabled only if managed is TRUE                                                                                                                                                                                                                        |
| downmix      | Boolean. Downmix input from stereo to mono (has no effect on non-stereo streams). Useful for lower-bitrate encoding.                                                                                                                                   |

## Description

These options were extracted from the OpenMAX IL spec and Gstreamer vorbisenc properties

For best quality users should specify VBR mode and set quality levels.

## Name

struct snd\_enc\_real —

## Synopsis

```
struct snd_enc_real {  
    __u32 quant_bits;  
    __u32 start_region;  
    __u32 num_regions;  
};
```

## Members

|              |                                                    |
|--------------|----------------------------------------------------|
| quant_bits   | number of coupling quantization bits in the stream |
| start_region | coupling start region in the stream                |
| num_regions  | number of regions value                            |

## Description

These options were extracted from the OpenMAX IL spec

## Name

struct snd\_enc\_flac —

## Synopsis

```
struct snd_enc_flac {  
    __u32 num;  
    __u32 gain;  
};
```

## Members

num     serial number, valid only for OGG formats needs to be set by application

gain    Add replay gain tags

## Description

These options were extracted from the FLAC online documentation at [http://flac.sourceforge.net/documentation\\_tools\\_flac.html](http://flac.sourceforge.net/documentation_tools_flac.html)

To make the API simpler, it is assumed that the user will select quality profiles. Additional options that affect encoding quality and speed can be added at a later stage if needed.

By default the Subset format is used by encoders.

TAGS such as pictures, etc, cannot be handled by an offloaded encoder and are not supported in this API.

## Name

struct snd\_compr\_runtime —

## Synopsis

```
struct snd_compr_runtime {
    snd_pcm_state_t state;
    struct snd_compr_ops * ops;
    void * buffer;
    u64 buffer_size;
    u32 fragment_size;
    u32 fragments;
    u64 total_bytes_available;
    u64 total_bytes_transferred;
    wait_queue_head_t sleep;
    void * private_data;
};
```

## Members

|                         |                                                                                          |
|-------------------------|------------------------------------------------------------------------------------------|
| state                   | stream state                                                                             |
| ops                     | pointer to DSP callbacks                                                                 |
| buffer                  | pointer to kernel buffer, valid only when not in mmap mode or DSP doesn't implement copy |
| buffer_size             | size of the above buffer                                                                 |
| fragment_size           | size of buffer fragment in bytes                                                         |
| fragments               | number of such fragments                                                                 |
| total_bytes_available   | cumulative number of bytes made available in the ring buffer                             |
| total_bytes_transferred | cumulative bytes transferred by offload DSP                                              |
| sleep                   | poll sleep                                                                               |
| private_data            | driver private data pointer                                                              |

## Name

struct snd\_compr\_stream —

## Synopsis

```
struct snd_compr_stream {
    const char * name;
    struct snd_compr_ops * ops;
    struct snd_compr_runtime * runtime;
    struct snd_compr * device;
    struct delayed_work error_work;
    enum snd_compr_direction direction;
    bool metadata_set;
    bool next_track;
    void * private_data;
};
```

## Members

|              |                                                           |
|--------------|-----------------------------------------------------------|
| name         | device name                                               |
| ops          | pointer to DSP callbacks                                  |
| runtime      | pointer to runtime structure                              |
| device       | device pointer                                            |
| error_work   | delayed work used when closing the stream due to an error |
| direction    | stream direction, playback/recording                      |
| metadata_set | metadata set flag, true when set                          |
| next_track   | has userspace signal next track transition, true when set |
| private_data | pointer to DSP private data                               |

## Name

struct snd\_compr\_ops —

## Synopsis

```
struct snd_compr_ops {
    int (* open) (struct snd_compr_stream *stream);
    int (* free) (struct snd_compr_stream *stream);
    int (* set_params) (struct snd_compr_stream *stream, struct snd_compr_params *par
    int (* get_params) (struct snd_compr_stream *stream, struct snd_codec *params);
    int (* set_metadata) (struct snd_compr_stream *stream, struct snd_compr_metadata
    int (* get_metadata) (struct snd_compr_stream *stream, struct snd_compr_metadata
    int (* trigger) (struct snd_compr_stream *stream, int cmd);
    int (* pointer) (struct snd_compr_stream *stream, struct snd_compr_tstamp *tstamp
    int (* copy) (struct snd_compr_stream *stream, char __user *buf, size_t count);
    int (* mmap) (struct snd_compr_stream *stream, struct vm_area_struct *vma);
    int (* ack) (struct snd_compr_stream *stream, size_t bytes);
    int (* get_caps) (struct snd_compr_stream *stream, struct snd_compr_caps *caps);
    int (* get_codec_caps) (struct snd_compr_stream *stream, struct snd_compr_codec_c
};
```

## Members

|                |                                                                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| open           | Open the compressed stream This callback is mandatory and shall keep dsp ready to receive the stream parameter                                   |
| free           | Close the compressed stream, mandatory                                                                                                           |
| set_params     | Sets the compressed stream parameters, mandatory This can be called in during stream creation only to set codec params and the stream properties |
| get_params     | retrieve the codec parameters, mandatory                                                                                                         |
| set_metadata   | Set the metadata values for a stream                                                                                                             |
| get_metadata   | retrieves the requested metadata values from stream                                                                                              |
| trigger        | Trigger operations like start, pause, resume, drain, stop. This callback is mandatory                                                            |
| pointer        | Retrieve current h/w pointer information. Mandatory                                                                                              |
| copy           | Copy the compressed data to/from userspace, Optional Can't be implemented if DSP supports mmap                                                   |
| mmap           | DSP mmap method to mmap DSP memory                                                                                                               |
| ack            | Ack for DSP when data is written to audio buffer, Optional Not valid if copy is implemented                                                      |
| get_caps       | Retrieve DSP capabilities, mandatory                                                                                                             |
| get_codec_caps | Retrieve capabilities for a specific codec, mandatory                                                                                            |

## Name

struct snd\_compr —

## Synopsis

```
struct snd_compr {
    const char * name;
    struct device dev;
    struct snd_compr_ops * ops;
    void * private_data;
    struct snd_card * card;
    unsigned int direction;
    struct mutex lock;
    int device;
#ifdef CONFIG_SND_VERBOSE_PROCFS
#endif
};
```

## Members

|              |                               |
|--------------|-------------------------------|
| name         | DSP device name               |
| dev          | associated device instance    |
| ops          | pointer to DSP callbacks      |
| private_data | pointer to DSP pvt data       |
| card         | sound card pointer            |
| direction    | Playback or capture direction |
| lock         | device lock                   |
| device       | device id                     |

---

# Chapter 7. ASoC

## ASoC Core API

## Name

struct snd\_soc\_jack\_pin — Describes a pin to update based on jack detection

## Synopsis

```
struct snd_soc_jack_pin {  
    struct list_head list;  
    const char * pin;  
    int mask;  
    bool invert;  
};
```

## Members

|        |                                                             |
|--------|-------------------------------------------------------------|
| list   | internal list entry                                         |
| pin    | name of the pin to update                                   |
| mask   | bits to check for in reported jack status                   |
| invert | if non-zero then pin is enabled when status is not reported |

## Name

struct snd\_soc\_jack\_zone — Describes voltage zones of jack detection

## Synopsis

```
struct snd_soc_jack_zone {
    unsigned int min_mv;
    unsigned int max_mv;
    unsigned int jack_type;
    unsigned int debounce_time;
    struct list_head list;
};
```

## Members

|               |                                                                                                        |
|---------------|--------------------------------------------------------------------------------------------------------|
| min_mv        | start voltage in mv                                                                                    |
| max_mv        | end voltage in mv                                                                                      |
| jack_type     | type of jack that is expected for this voltage                                                         |
| debounce_time | debounce_time for jack, codec driver should wait for this duration before reading the adc for voltages |
| list          | internal list entry                                                                                    |

## Name

struct snd\_soc\_jack\_gpio — Describes a gpio pin for jack detection

## Synopsis

```
struct snd_soc_jack_gpio {
    unsigned int gpio;
    unsigned int idx;
    struct device * gpiod_dev;
    const char * name;
    int report;
    int invert;
    int debounce_time;
    bool wake;
    int (* jack_status_check) (void *data);
};
```

## Members

|                   |                                                                                                      |
|-------------------|------------------------------------------------------------------------------------------------------|
| gpio              | legacy gpio number                                                                                   |
| idx               | gpio descriptor index within the function of the GPIO consumer device                                |
| gpiod_dev         | GPIO consumer device                                                                                 |
| name              | gpio name. Also as connection ID for the GPIO consumer device function name lookup                   |
| report            | value to report when jack detected                                                                   |
| invert            | report presence in low state                                                                         |
| debounce_time     | debounce time in ms                                                                                  |
| wake              | enable as wake source                                                                                |
| jack_status_check | callback function which overrides the detection to provide more complex checks (eg, reading an ADC). |

## Name

`snd_soc_component_to_codec` — Casts a component to the CODEC it is embedded in

## Synopsis

```
struct    snd_soc_codec    *    snd_soc_component_to_codec    (struct  
snd_soc_component * component);
```

## Arguments

*component*    The component to cast to a CODEC

## Description

This function must only be used on components that are known to be CODECs. Otherwise the behavior is undefined.

## Name

`snd_soc_component_to_platform` — Casts a component to the platform it is embedded in

## Synopsis

```
struct snd_soc_platform * snd_soc_component_to_platform (struct
snd_soc_component * component);
```

## Arguments

*component*    The component to cast to a platform

## Description

This function must only be used on components that are known to be platforms. Otherwise the behavior is undefined.

## Name

`snd_soc_dapm_to_component` — Casts a DAPM context to the component it is embedded in

## Synopsis

```
struct snd_soc_component * snd_soc_dapm_to_component (struct
snd_soc_dapm_context * dapm);
```

## Arguments

*dapm* The DAPM context to cast to the component

## Description

This function must only be used on DAPM contexts that are known to be part of a component (e.g. in a component driver). Otherwise the behavior is undefined.

## Name

`snd_soc_dapm_to_codec` — Casts a DAPM context to the CODEC it is embedded in

## Synopsis

```
struct      snd_soc_codec      *      snd_soc_dapm_to_codec      (struct  
snd_soc_dapm_context * dapm);
```

## Arguments

*dapm* The DAPM context to cast to the CODEC

## Description

This function must only be used on DAPM contexts that are known to be part of a CODEC (e.g. in a CODEC driver). Otherwise the behavior is undefined.

## Name

`snd_soc_dapm_to_platform` — Casts a DAPM context to the platform it is embedded in

## Synopsis

```
struct snd_soc_platform * snd_soc_dapm_to_platform (struct
snd_soc_dapm_context * dapm);
```

## Arguments

*dapm* The DAPM context to cast to the platform.

## Description

This function must only be used on DAPM contexts that are known to be part of a platform (e.g. in a platform driver). Otherwise the behavior is undefined.

## Name

`snd_soc_component_get_dapm` — Returns the DAPM context associated with a component

## Synopsis

```
struct snd_soc_dapm_context * snd_soc_component_get_dapm (struct  
snd_soc_component * component);
```

## Arguments

*component* The component for which to get the DAPM context

## Name

`snd_soc_codec_get_dapm` — Returns the DAPM context for the CODEC

## Synopsis

```
struct snd_soc_dapm_context * snd_soc_codec_get_dapm (struct  
snd_soc_codec * codec);
```

## Arguments

*codec* The CODEC for which to get the DAPM context

## Note

Use this function instead of directly accessing the CODEC's dapm field

## Name

`snd_soc_codec_init_bias_level` — Initialize CODEC DAPM bias level

## Synopsis

```
void snd_soc_codec_init_bias_level (struct snd_soc_codec * codec, enum  
snd_soc_bias_level level);
```

## Arguments

*codec*    The CODEC for which to initialize the DAPM bias level

*level*    The DAPM level to initialize to

## Description

Initializes the CODEC DAPM bias level. See `snd_soc_dapm_init_bias_level`.

## Name

`snd_soc_codec_get_bias_level` — Get current CODEC DAPM bias level

## Synopsis

```
enum      snd_soc_bias_level      snd_soc_codec_get_bias_level      (struct  
snd_soc_codec * codec);
```

## Arguments

*codec*    The CODEC for which to get the DAPM bias level

## Return

The current DAPM bias level of the CODEC.

## Name

`snd_soc_codec_force_bias_level` — Set the CODEC DAPM bias level

## Synopsis

```
int snd_soc_codec_force_bias_level (struct snd_soc_codec * codec, enum
snd_soc_bias_level level);
```

## Arguments

*codec*    The CODEC for which to set the level

*level*    The level to set to

## Description

Forces the CODEC bias level to a specific state. See `snd_soc_dapm_force_bias_level`.

## Name

`snd_soc_dapm_kcontrol_codec` — Returns the codec associated to a `kcontrol`

## Synopsis

```
struct snd_soc_codec * snd_soc_dapm_kcontrol_codec (struct snd_kcontrol  
* kcontrol);
```

## Arguments

*kcontrol*    The `kcontrol`

## Description

This function must only be used on DAPM contexts that are known to be part of a CODEC (e.g. in a CODEC driver). Otherwise the behavior is undefined.

## Name

`snd_soc_cache_sync` — Sync the register cache with the hardware

## Synopsis

```
int snd_soc_cache_sync (struct snd_soc_codec * codec);
```

## Arguments

*codec* CODEC to sync

## Note

This function will call `regcache_sync`

## Name

`snd_soc_codec_init_regmap` — Initialize regmap instance for the CODEC

## Synopsis

```
void snd_soc_codec_init_regmap (struct snd_soc_codec * codec, struct  
regmap * regmap);
```

## Arguments

*codec*     The CODEC for which to initialize the regmap instance

*regmap*   The regmap instance that should be used by the CODEC

## Description

This function allows deferred assignment of the regmap instance that is associated with the CODEC. Only use this if the regmap instance is not yet ready when the CODEC is registered. The function must also be called before the first IO attempt of the CODEC.

## Name

`snd_soc_codec_exit_regmap` — De-initialize regmap instance for the CODEC

## Synopsis

```
void snd_soc_codec_exit_regmap (struct snd_soc_codec * codec);
```

## Arguments

*codec*    The CODEC for which to de-initialize the regmap instance

## Description

Calls `regmap_exit` on the regmap instance associated to the CODEC and removes the regmap instance from the CODEC.

This function should only be used if `snd_soc_codec_init_regmap` was used to initialize the regmap instance.

## Name

`snd_soc_kcontrol_component` — Returns the component that registered the control

## Synopsis

```
struct snd_soc_component * snd_soc_kcontrol_component (struct  
snd_kcontrol * kcontrol);
```

## Arguments

*kcontrol* The control for which to get the component

## Note

This function will work correctly if the control has been registered for a component. Either with `snd_soc_add_codec_controls` or `snd_soc_add_platform_controls` or via table based setup for either a CODEC, a platform or component driver. Otherwise the behavior is undefined.

## Name

`snd_soc_kcontrol_codec` — Returns the CODEC that registered the control

## Synopsis

```
struct snd_soc_codec * snd_soc_kcontrol_codec (struct snd_kcontrol *  
kcontrol);
```

## Arguments

*kcontrol* The control for which to get the CODEC

## Note

This function will only work correctly if the control has been registered with `snd_soc_add_codec_controls` or via table based setup of `snd_soc_codec_driver`. Otherwise the behavior is undefined.

## Name

`snd_soc_kcontrol_platform` — Returns the platform that registered the control

## Synopsis

```
struct snd_soc_platform * snd_soc_kcontrol_platform (struct
snd_kcontrol * kcontrol);
```

## Arguments

*kcontrol* The control for which to get the platform

## Note

This function will only work correctly if the control has been registered with `snd_soc_add_platform_controls` or via table based setup of a `snd_soc_platform_driver`. Otherwise the behavior is undefined.

## Name

`snd_soc_find_dai` — Find a registered DAI

## Synopsis

```
struct snd_soc_dai * snd_soc_find_dai (const struct  
snd_soc_dai_link_component * dlc);
```

## Arguments

*dlc* name of the DAI and optional component info to match

## Description

This function will search all registered components and their DAIs to find the DAI of the same name. The component's `of_node` and name should also match if being specified.

## Return

pointer of DAI, or NULL if not found.

## Name

`snd_soc_add_dai_link` — Add a DAI link dynamically

## Synopsis

```
int  snd_soc_add_dai_link (struct  snd_soc_card  *  card,  struct
snd_soc_dai_link * dai_link);
```

## Arguments

*card*            The ASoC card to which the DAI link is added

*dai\_link*       The new DAI link to add

## Description

This function adds a DAI link to the ASoC card's link list.

## Note

Topology can use this API to add DAI links when probing the topology component. And machine drivers can still define static DAI links in `dai_link` array.

## Name

`snd_soc_remove_dai_link` — Remove a DAI link from the list

## Synopsis

```
void snd_soc_remove_dai_link (struct snd_soc_card * card, struct
snd_soc_dai_link * dai_link);
```

## Arguments

*card*            The ASoC card that owns the link

*dai\_link*       The DAI link to remove

## Description

This function removes a DAI link from the ASoC card's link list.

For DAI links previously added by topology, topology should remove them by using the `dobj` embedded in the link.

## Name

`snd_soc_runtime_set_dai_fmt` — Change DAI link format for a ASoC runtime

## Synopsis

```
int snd_soc_runtime_set_dai_fmt (struct snd_soc_pcm_runtime * rtd, unsigned int dai_fmt);
```

## Arguments

*rtd*            The runtime for which the DAI link format should be changed

*dai\_fmt*      The new DAI link format

## Description

This function updates the DAI link format for all DAIs connected to the DAI link for the specified runtime.

## Note

For setups with a static format set the `dai_fmt` field in the corresponding `snd_dai_link` struct instead of using this function.

Returns 0 on success, otherwise a negative error code.

## Name

`snd_soc_cnew` — create new control

## Synopsis

```
struct snd_kcontrol * snd_soc_cnew (const struct snd_kcontrol_new *  
_template, void * data, const char * long_name, const char * prefix);
```

## Arguments

|                  |                      |
|------------------|----------------------|
| <i>_template</i> | control template     |
| <i>data</i>      | control private data |
| <i>long_name</i> | control long name    |
| <i>prefix</i>    | control name prefix  |

## Description

Create a new mixer control from a template control.

Returns 0 for success, else error.

## Name

`snd_soc_add_component_controls` — Add an array of controls to a component.

## Synopsis

```
int snd_soc_add_component_controls (struct snd_soc_component * com-  
ponent, const struct snd_kcontrol_new * controls, unsigned int  
num_controls);
```

## Arguments

|                     |                                 |
|---------------------|---------------------------------|
| <i>component</i>    | Component to add controls to    |
| <i>controls</i>     | Array of controls to add        |
| <i>num_controls</i> | Number of elements in the array |

## Return

0 for success, else error.

## Name

`snd_soc_add_codec_controls` — add an array of controls to a codec. Convenience function to add a list of controls. Many codecs were duplicating this code.

## Synopsis

```
int snd_soc_add_codec_controls (struct snd_soc_codec * codec, const
struct snd_kcontrol_new * controls, unsigned int num_controls);
```

## Arguments

|                     |                                 |
|---------------------|---------------------------------|
| <i>codec</i>        | codec to add controls to        |
| <i>controls</i>     | array of controls to add        |
| <i>num_controls</i> | number of elements in the array |

## Description

Return 0 for success, else error.

## Name

`snd_soc_add_platform_controls` — add an array of controls to a platform. Convenience function to add a list of controls.

## Synopsis

```
int snd_soc_add_platform_controls (struct snd_soc_platform * platform,  
const struct snd_kcontrol_new * controls, unsigned int num_controls);
```

## Arguments

|                     |                                 |
|---------------------|---------------------------------|
| <i>platform</i>     | platform to add controls to     |
| <i>controls</i>     | array of controls to add        |
| <i>num_controls</i> | number of elements in the array |

## Description

Return 0 for success, else error.

## Name

`snd_soc_add_card_controls` — add an array of controls to a SoC card. Convenience function to add a list of controls.

## Synopsis

```
int snd_soc_add_card_controls (struct snd_soc_card * soc_card, const
struct snd_kcontrol_new * controls, int num_controls);
```

## Arguments

|                     |                                 |
|---------------------|---------------------------------|
| <i>soc_card</i>     | SoC card to add controls to     |
| <i>controls</i>     | array of controls to add        |
| <i>num_controls</i> | number of elements in the array |

## Description

Return 0 for success, else error.

## Name

`snd_soc_add_dai_controls` — add an array of controls to a DAI. Convenience function to add a list of controls.

## Synopsis

```
int snd_soc_add_dai_controls (struct snd_soc_dai * dai, const struct
snd_kcontrol_new * controls, int num_controls);
```

## Arguments

|                     |                                 |
|---------------------|---------------------------------|
| <i>dai</i>          | DAI to add controls to          |
| <i>controls</i>     | array of controls to add        |
| <i>num_controls</i> | number of elements in the array |

## Description

Return 0 for success, else error.

## Name

`snd_soc_dai_set_sysclk` — configure DAI system or master clock.

## Synopsis

```
int snd_soc_dai_set_sysclk (struct snd_soc_dai * dai, int clk_id, unsigned int freq, int dir);
```

## Arguments

|               |                                     |
|---------------|-------------------------------------|
| <i>dai</i>    | DAI                                 |
| <i>clk_id</i> | DAI specific clock ID               |
| <i>freq</i>   | new clock frequency in Hz           |
| <i>dir</i>    | new clock direction - input/output. |

## Description

Configures the DAI master (MCLK) or system (SYSCLK) clocking.

## Name

`snd_soc_codec_set_sysclk` — configure CODEC system or master clock.

## Synopsis

```
int snd_soc_codec_set_sysclk (struct snd_soc_codec * codec, int clk_id,  
int source, unsigned int freq, int dir);
```

## Arguments

*codec*     CODEC

*clk\_id*    DAI specific clock ID

*source*    Source for the clock

*freq*      new clock frequency in Hz

*dir*       new clock direction - input/output.

## Description

Configures the CODEC master (MCLK) or system (SYSCLK) clocking.

## Name

`snd_soc_dai_set_clkdiv` — configure DAI clock dividers.

## Synopsis

```
int snd_soc_dai_set_clkdiv (struct snd_soc_dai * dai, int div_id, int  
div);
```

## Arguments

*dai*        DAI

*div\_id*    DAI specific clock divider ID

*div*        new clock divisor.

## Description

Configures the clock dividers. This is used to derive the best DAI bit and frame clocks from the system or master clock. It's best to set the DAI bit and frame clocks as low as possible to save system power.

## Name

`snd_soc_dai_set_pll` — configure DAI PLL.

## Synopsis

```
int snd_soc_dai_set_pll (struct snd_soc_dai * dai, int pll_id, int source, unsigned int freq_in, unsigned int freq_out);
```

## Arguments

|                 |                                            |
|-----------------|--------------------------------------------|
| <i>dai</i>      | DAI                                        |
| <i>pll_id</i>   | DAI specific PLL ID                        |
| <i>source</i>   | DAI specific source for the PLL            |
| <i>freq_in</i>  | PLL input clock frequency in Hz            |
| <i>freq_out</i> | requested PLL output clock frequency in Hz |

## Description

Configures and enables PLL to generate output clock based on input clock.

## Name

`snd_soc_dai_set_bclk_ratio` — configure BCLK to sample rate ratio.

## Synopsis

```
int snd_soc_dai_set_bclk_ratio (struct snd_soc_dai * dai, unsigned int  
ratio);
```

## Arguments

*dai*     DAI

*ratio*   Ratio of BCLK to Sample rate.

## Description

Configures the DAI for a preset BCLK to sample rate ratio.

## Name

`snd_soc_dai_set_fmt` — configure DAI hardware audio format.

## Synopsis

```
int snd_soc_dai_set_fmt (struct snd_soc_dai * dai, unsigned int fmt);
```

## Arguments

*dai* DAI

*fmt* SND\_SOC\_DAIFMT\_ format value.

## Description

Configures the DAI hardware format and clocking.

## Name

`snd_soc_dai_set_tdm_slot` — Configures a DAI for TDM operation

## Synopsis

```
int snd_soc_dai_set_tdm_slot (struct snd_soc_dai * dai, unsigned int
tx_mask, unsigned int rx_mask, int slots, int slot_width);
```

## Arguments

|                   |                                       |
|-------------------|---------------------------------------|
| <i>dai</i>        | The DAI to configure                  |
| <i>tx_mask</i>    | bitmask representing active TX slots. |
| <i>rx_mask</i>    | bitmask representing active RX slots. |
| <i>slots</i>      | Number of slots in use.               |
| <i>slot_width</i> | Width in bits for each slot.          |

## Description

This function configures the specified DAI for TDM operation. *slot* contains the total number of slots of the TDM stream and *slot\_width* the width of each slot in bit clock cycles. *tx\_mask* and *rx\_mask* are bitmasks specifying the active slots of the TDM stream for the specified DAI, i.e. which slots the DAI should write to or read from. If a bit is set the corresponding slot is active, if a bit is cleared the corresponding slot is inactive. Bit 0 maps to the first slot, bit 1 to the second slot and so on. The first active slot maps to the first channel of the DAI, the second active slot to the second channel and so on.

TDM mode can be disabled by passing 0 for *slots*. In this case *tx\_mask*, *rx\_mask* and *slot\_width* will be ignored.

Returns 0 on success, a negative error code otherwise.

## Name

`snd_soc_dai_set_channel_map` — configure DAI audio channel map

## Synopsis

```
int snd_soc_dai_set_channel_map (struct snd_soc_dai * dai, unsigned int
    tx_num, unsigned int * tx_slot, unsigned int rx_num, unsigned int *
    rx_slot);
```

## Arguments

|                |                                                                         |
|----------------|-------------------------------------------------------------------------|
| <i>dai</i>     | DAI                                                                     |
| <i>tx_num</i>  | how many TX channels                                                    |
| <i>tx_slot</i> | pointer to an array which imply the TX slot number channel 0~num-1 uses |
| <i>rx_num</i>  | how many RX channels                                                    |
| <i>rx_slot</i> | pointer to an array which imply the RX slot number channel 0~num-1 uses |

## Description

configure the relationship between channel number and TDM slot number.

## Name

`snd_soc_dai_set_tristate` — configure DAI system or master clock.

## Synopsis

```
int snd_soc_dai_set_tristate (struct snd_soc_dai * dai, int tristate);
```

## Arguments

*dai*            DAI

*tristate*    tristate enable

## Description

Tristates the DAI so that others can use it.

## Name

`snd_soc_dai_digital_mute` — configure DAI system or master clock.

## Synopsis

```
int snd_soc_dai_digital_mute (struct snd_soc_dai * dai, int mute, int
direction);
```

## Arguments

*dai*            DAI

*mute*           mute enable

*direction*    stream to mute

## Description

Mutes the DAI DAC.

## Name

`snd_soc_register_card` — Register a card with the ASoC core

## Synopsis

```
int snd_soc_register_card (struct snd_soc_card * card);
```

## Arguments

*card* Card to register

## Name

`snd_soc_unregister_card` — Unregister a card with the ASoC core

## Synopsis

```
int snd_soc_unregister_card (struct snd_soc_card * card);
```

## Arguments

*card* Card to unregister

## Name

`snd_soc_register_dai` — Register a DAI dynamically & create its widgets

## Synopsis

```
int snd_soc_register_dai (struct snd_soc_component * component, struct
snd_soc_dai_driver * dai_drv);
```

## Arguments

*component*    The component the DAIs are registered for

*dai\_drv*       DAI driver to use for the DAI

## Description

Topology can use this API to register DAIs when probing a component. These DAIs's widgets will be freed in the card cleanup and the DAIs will be freed in the component cleanup.

## Name

`snd_soc_component_init_regmap` — Initialize regmap instance for the component

## Synopsis

```
void snd_soc_component_init_regmap (struct snd_soc_component * component, struct regmap * regmap);
```

## Arguments

*component*    The component for which to initialize the regmap instance

*regmap*        The regmap instance that should be used by the component

## Description

This function allows deferred assignment of the regmap instance that is associated with the component. Only use this if the regmap instance is not yet ready when the component is registered. The function must also be called before the first IO attempt of the component.

## Name

`snd_soc_component_exit_regmap` — De-initialize regmap instance for the component

## Synopsis

```
void snd_soc_component_exit_regmap (struct snd_soc_component * component);
```

## Arguments

*component*    The component for which to de-initialize the regmap instance

## Description

Calls `regmap_exit` on the regmap instance associated to the component and removes the regmap instance from the component.

This function should only be used if `snd_soc_component_init_regmap` was used to initialize the regmap instance.

## Name

`snd_soc_unregister_component` — Unregister a component from the ASoC core

## Synopsis

```
void snd_soc_unregister_component (struct device * dev);
```

## Arguments

*dev*    The device to unregister

## Name

`snd_soc_add_platform` — Add a platform to the ASoC core

## Synopsis

```
int snd_soc_add_platform (struct device * dev, struct snd_soc_platform
* platform, const struct snd_soc_platform_driver * platform_drv);
```

## Arguments

*dev*                    The parent device for the platform

*platform*            The platform to add

*platform\_drv*   The driver for the platform

## Name

`snd_soc_register_platform` — Register a platform with the ASoC core

## Synopsis

```
int snd_soc_register_platform (struct device * dev, const struct  
snd_soc_platform_driver * platform_drv);
```

## Arguments

*dev*                    The device for the platform

*platform\_drv*        The driver for the platform

## Name

`snd_soc_remove_platform` — Remove a platform from the ASoC core

## Synopsis

```
void snd_soc_remove_platform (struct snd_soc_platform * platform);
```

## Arguments

*platform* the platform to remove

## Name

`snd_soc_unregister_platform` — Unregister a platform from the ASoC core

## Synopsis

```
void snd_soc_unregister_platform (struct device * dev);
```

## Arguments

*dev* platform to unregister

## Name

`snd_soc_register_codec` — Register a codec with the ASoC core

## Synopsis

```
int  snd_soc_register_codec (struct device * dev, const struct
snd_soc_codec_driver * codec_drv, struct snd_soc_dai_driver * dai_drv,
int num_dai);
```

## Arguments

*dev*            The parent device for this codec

*codec\_drv*    Codec driver

*dai\_drv*       The associated DAI driver

*num\_dai*       Number of DAIs

## Name

`snd_soc_unregister_codec` — Unregister a codec from the ASoC core

## Synopsis

```
void snd_soc_unregister_codec (struct device * dev);
```

## Arguments

*dev*    codec to unregister

## Name

`devm_snd_soc_register_component` — resource managed component registration

## Synopsis

```
int devm_snd_soc_register_component (struct device * dev, const struct
snd_soc_component_driver * cmpnt_drv, struct snd_soc_dai_driver *
dai_drv, int num_dai);
```

## Arguments

*dev*            Device used to manage component

*cmpnt\_drv*    Component driver

*dai\_drv*       DAI driver

*num\_dai*       Number of DAIs to register

## Description

Register a component with automatic unregistration when the device is unregistered.

## Name

`devm_snd_soc_register_platform` — resource managed platform registration

## Synopsis

```
int devm_snd_soc_register_platform (struct device * dev, const struct  
snd_soc_platform_driver * platform_drv);
```

## Arguments

*dev*                      Device used to manage platform

*platform\_drv*   platform to register

## Description

Register a platform driver with automatic unregistration when the device is unregistered.

## Name

`devm_snd_soc_register_card` — resource managed card registration

## Synopsis

```
int devm_snd_soc_register_card (struct device * dev, struct snd_soc_card  
* card);
```

## Arguments

*dev*     Device used to manage card

*card*    Card to register

## Description

Register a card with automatic unregistration when the device is unregistered.

## Name

`devm_snd_dmaengine_pcm_register` — resource managed dmaengine PCM registration

## Synopsis

```
int devm_snd_dmaengine_pcm_register (struct device * dev, const struct  
snd_dmaengine_pcm_config * config, unsigned int flags);
```

## Arguments

*dev*        The parent device for the PCM device

*config*    Platform specific PCM configuration

*flags*     Platform specific quirks

## Description

Register a dmaengine based PCM device with automatic unregistration when the device is unregistered.

## Name

`snd_soc_component_read` — Read register value

## Synopsis

```
int snd_soc_component_read (struct snd_soc_component * component, unsigned int reg, unsigned int * val);
```

## Arguments

|                  |                                           |
|------------------|-------------------------------------------|
| <i>component</i> | Component to read from                    |
| <i>reg</i>       | Register to read                          |
| <i>val</i>       | Pointer to where the read value is stored |

## Return

0 on success, a negative error code otherwise.

## Name

`snd_soc_component_write` — Write register value

## Synopsis

```
int snd_soc_component_write (struct snd_soc_component * component, unsigned int reg, unsigned int val);
```

## Arguments

*component*    Component to write to

*reg*            Register to write

*val*            Value to write to the register

## Return

0 on success, a negative error code otherwise.

## Name

`snd_soc_component_update_bits` — Perform read/modify/write cycle

## Synopsis

```
int snd_soc_component_update_bits (struct snd_soc_component * component, unsigned int reg, unsigned int mask, unsigned int val);
```

## Arguments

|                  |                                          |
|------------------|------------------------------------------|
| <i>component</i> | Component to update                      |
| <i>reg</i>       | Register to update                       |
| <i>mask</i>      | Mask that specifies which bits to update |
| <i>val</i>       | New value for the bits specified by mask |

## Return

1 if the operation was successful and the value of the register changed, 0 if the operation was successful, but the value did not change. Returns a negative error code otherwise.

## Name

`snd_soc_component_update_bits_async` — Perform asynchronous read/modify/write cycle

## Synopsis

```
int snd_soc_component_update_bits_async (struct snd_soc_component *  
component, unsigned int reg, unsigned int mask, unsigned int val);
```

## Arguments

|                  |                                          |
|------------------|------------------------------------------|
| <i>component</i> | Component to update                      |
| <i>reg</i>       | Register to update                       |
| <i>mask</i>      | Mask that specifies which bits to update |
| <i>val</i>       | New value for the bits specified by mask |

## Description

This function is similar to `snd_soc_component_update_bits`, but the update operation is scheduled asynchronously. This means it may not be completed when the function returns. To make sure that all scheduled updates have been completed `snd_soc_component_async_complete` must be called.

## Return

1 if the operation was successful and the value of the register changed, 0 if the operation was successful, but the value did not change. Returns a negative error code otherwise.

## Name

`snd_soc_component_async_complete` — Ensure asynchronous I/O has completed

## Synopsis

```
void snd_soc_component_async_complete (struct snd_soc_component * com-  
ponent);
```

## Arguments

*component*    Component for which to wait

## Description

This function blocks until all asynchronous I/O which has previously been scheduled using `snd_soc_component_update_bits_async` has completed.

## Name

`snd_soc_component_test_bits` — Test register for change

## Synopsis

```
int snd_soc_component_test_bits (struct snd_soc_component * component,
unsigned int reg, unsigned int mask, unsigned int value);
```

## Arguments

|                  |                                        |
|------------------|----------------------------------------|
| <i>component</i> | component                              |
| <i>reg</i>       | Register to test                       |
| <i>mask</i>      | Mask that specifies which bits to test |
| <i>value</i>     | Value to test against                  |

## Description

Tests a register with a new value and checks if the new value is different from the old value.

## Return

1 for change, otherwise 0.

## Name

`snd_soc_update_bits` — update codec register bits

## Synopsis

```
int snd_soc_update_bits (struct snd_soc_codec * codec, unsigned int reg,  
unsigned int mask, unsigned int value);
```

## Arguments

*codec*    audio codec  
*reg*      codec register  
*mask*    register mask  
*value*    new value

## Description

Writes new register value.

Returns 1 for change, 0 for no change, or negative error code.

## Name

`snd_soc_test_bits` — test register for change

## Synopsis

```
int snd_soc_test_bits (struct snd_soc_codec * codec, unsigned int reg,  
unsigned int mask, unsigned int value);
```

## Arguments

*codec*    audio codec

*reg*      codec register

*mask*    register mask

*value*    new value

## Description

Tests a register with a new value and checks if the new value is different from the old value.

Returns 1 for change else 0.

## Name

`snd_soc_set_runtime_hwparams` — set the runtime hardware parameters

## Synopsis

```
int snd_soc_set_runtime_hwparams (struct snd_pcm_substream * substream,  
const struct snd_pcm_hwparams * hw);
```

## Arguments

*substream*    the pcm substream

*hw*            the hardware parameters

## Description

Sets the substream runtime hardware parameters.

## Name

`snd_soc_info_enum_double` — enumerated double mixer info callback

## Synopsis

```
int snd_soc_info_enum_double (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_info * uinfo);
```

## Arguments

*kcontrol*    mixer control

*uinfo*       control element information

## Description

Callback to provide information about a double enumerated mixer control.

Returns 0 for success.

## Name

`snd_soc_get_enum_double` — enumerated double mixer get callback

## Synopsis

```
int snd_soc_get_enum_double (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to get the value of a double enumerated mixer.

Returns 0 for success.

## Name

`snd_soc_put_enum_double` — enumerated double mixer put callback

## Synopsis

```
int snd_soc_put_enum_double (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to set the value of a double enumerated mixer.

Returns 0 for success.

## Name

`snd_soc_info_volsw` — single mixer info callback

## Synopsis

```
int  snd_soc_info_volsw (struct  snd_kcontrol  *  kcontrol,  struct
snd_ctl_elem_info * uinfo);
```

## Arguments

*kcontrol* mixer control

*uinfo* control element information

## Description

Callback to provide information about a single mixer control, or a double mixer control that spans 2 registers.

Returns 0 for success.

## Name

`snd_soc_info_volsw_sx` — Mixer info callback for SX TLV controls

## Synopsis

```
int snd_soc_info_volsw_sx (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_info * uinfo);
```

## Arguments

*kcontrol*    mixer control

*uinfo*       control element information

## Description

Callback to provide information about a single mixer control, or a double mixer control that spans 2 registers of the SX TLV type. SX TLV controls have a range that represents both positive and negative values either side of zero but without a sign bit.

Returns 0 for success.

## Name

`snd_soc_get_volsw` — single mixer get callback

## Synopsis

```
int  snd_soc_get_volsw (struct  snd_kcontrol  *  kcontrol,  struct  
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to get the value of a single mixer control, or a double mixer control that spans 2 registers.

Returns 0 for success.

## Name

`snd_soc_put_volsw` — single mixer put callback

## Synopsis

```
int snd_soc_put_volsw (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to set the value of a single mixer control, or a double mixer control that spans 2 registers.

Returns 0 for success.

## Name

`snd_soc_get_volsw_sx` — single mixer get callback

## Synopsis

```
int  snd_soc_get_volsw_sx (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to get the value of a single mixer control, or a double mixer control that spans 2 registers.

Returns 0 for success.

## Name

`snd_soc_put_volsw_sx` — double mixer set callback

## Synopsis

```
int  snd_soc_put_volsw_sx (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to set the value of a double mixer control that spans 2 registers.

Returns 0 for success.

## Name

`snd_soc_info_volsw_range` — single mixer info callback with range.

## Synopsis

```
int snd_soc_info_volsw_range (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_info * uinfo);
```

## Arguments

*kcontrol*    mixer control

*uinfo*       control element information

## Description

Callback to provide information, within a range, about a single mixer control.

returns 0 for success.

## Name

`snd_soc_put_volsw_range` — single mixer put value callback with range.

## Synopsis

```
int snd_soc_put_volsw_range (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to set the value, within a range, for a single mixer control.

Returns 0 for success.

## Name

`snd_soc_get_volsw_range` — single mixer get callback with range

## Synopsis

```
int snd_soc_get_volsw_range (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to get the value, within a range, of a single mixer control.

Returns 0 for success.

## Name

`snd_soc_limit_volume` — Set new limit to an existing volume control.

## Synopsis

```
int snd_soc_limit_volume (struct snd_soc_card * card, const char * name,  
int max);
```

## Arguments

*card*    where to look for the control

*name*    Name of the control

*max*     new maximum limit

## Description

Return 0 for success, else error.

## Name

`snd_soc_info_xr_sx` — signed multi register info callback

## Synopsis

```
int  snd_soc_info_xr_sx (struct  snd_kcontrol  *  kcontrol,  struct
snd_ctl_elem_info * uinfo);
```

## Arguments

*kcontrol* mreg control

*uinfo* control element information

## Description

Callback to provide information of a control that can span multiple codec registers which together forms a single signed value in a MSB/LSB manner.

Returns 0 for success.

## Name

`snd_soc_get_xr_sx` — signed multi register get callback

## Synopsis

```
int  snd_soc_get_xr_sx (struct  snd_kcontrol  *  kcontrol,  struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mreg control

*ucontrol* control element information

## Description

Callback to get the value of a control that can span multiple codec registers which together forms a single signed value in a MSB/LSB manner. The control supports specifying total no of bits used to allow for bitfields across the multiple codec registers.

Returns 0 for success.

## Name

`snd_soc_put_xr_sx` — signed multi register get callback

## Synopsis

```
int  snd_soc_put_xr_sx (struct  snd_kcontrol  *  kcontrol,  struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mreg control

*ucontrol* control element information

## Description

Callback to set the value of a control that can span multiple codec registers which together forms a single signed value in a MSB/LSB manner. The control supports specifying total no of bits used to allow for bitfields across the multiple codec registers.

Returns 0 for success.

## Name

`snd_soc_get_strobe` — strobe get callback

## Synopsis

```
int  snd_soc_get_strobe (struct  snd_kcontrol  *  kcontrol,  struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback get the value of a strobe mixer control.

Returns 0 for success.

## Name

`snd_soc_put_strobe` — strobe put callback

## Synopsis

```
int  snd_soc_put_strobe (struct  snd_kcontrol  *  kcontrol,  struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback strobe a register bit to high then low (or the inverse) in one pass of a single mixer enum control.

Returns 1 for success.

## Name

`snd_soc_new_compress` — create a new compress.

## Synopsis

```
int snd_soc_new_compress (struct snd_soc_pcm_runtime * rtd, int num);
```

## Arguments

*rtd*    The runtime for which we will create compress

*num*    the device index number (zero based - shared with normal PCMs)

## Return

0 for success, else error.

# ASoC DAPM API

## Name

`snd_soc_dapm_kcontrol_widget` — Returns the widget associated to a `kcontrol`

## Synopsis

```
struct snd_soc_dapm_widget * snd_soc_dapm_kcontrol_widget (struct  
snd_kcontrol * kcontrol);
```

## Arguments

*kcontrol* The `kcontrol`

## Name

`snd_soc_dapm_kcontrol_dapm` — Returns the dapm context associated to a kcontrol

## Synopsis

```
struct snd_soc_dapm_context * snd_soc_dapm_kcontrol_dapm (struct  
snd_kcontrol * kcontrol);
```

## Arguments

*kcontrol* The kcontrol

## Note

This function must only be used on kcontrols that are known to have been registered for a CODEC. Otherwise the behaviour is undefined.

## Name

`snd_soc_dapm_force_bias_level` — Sets the DAPM bias level

## Synopsis

```
int snd_soc_dapm_force_bias_level (struct snd_soc_dapm_context * dapm,  
enum snd_soc_bias_level level);
```

## Arguments

*dapm*    The DAPM context for which to set the level

*level*   The level to set

## Description

Forces the DAPM bias level to a specific state. It will call the bias level callback of DAPM context with the specified level. This will even happen if the context is already at the same level. Furthermore it will not go through the normal bias level sequencing, meaning any intermediate states between the current and the target state will not be entered.

Note that the change in bias level is only temporary and the next time `snd_soc_dapm_sync` is called the state will be set to the level as determined by the DAPM core. The function is mainly intended to be used to used during probe or resume from suspend to power up the device so initialization can be done, before the DAPM core takes over.

## Name

`snd_soc_dapm_sync_unlocked` — scan and power dapm paths

## Synopsis

```
int snd_soc_dapm_sync_unlocked (struct snd_soc_dapm_context * dapm);
```

## Arguments

*dapm* DAPM context

## Description

Walks all dapm audio paths and powers widgets according to their stream or path usage.

Requires external locking.

Returns 0 for success.

## Name

`snd_soc_dapm_sync` — scan and power dapm paths

## Synopsis

```
int snd_soc_dapm_sync (struct snd_soc_dapm_context * dapm);
```

## Arguments

*dapm* DAPM context

## Description

Walks all dapm audio paths and powers widgets according to their stream or path usage.

Returns 0 for success.

## Name

`snd_soc_dapm_add_routes` — Add routes between DAPM widgets

## Synopsis

```
int snd_soc_dapm_add_routes (struct snd_soc_dapm_context * dapm, const
struct snd_soc_dapm_route * route, int num);
```

## Arguments

*dapm*     DAPM context

*route*    audio routes

*num*      number of routes

## Description

Connects 2 dapm widgets together via a named audio path. The sink is the widget receiving the audio signal, whilst the source is the sender of the audio signal.

Returns 0 for success else error. On error all resources can be freed with a call to `snd_soc_card_free`.

## Name

`snd_soc_dapm_del_routes` — Remove routes between DAPM widgets

## Synopsis

```
int snd_soc_dapm_del_routes (struct snd_soc_dapm_context * dapm, const
struct snd_soc_dapm_route * route, int num);
```

## Arguments

*dapm*     DAPM context

*route*    audio routes

*num*       number of routes

## Description

Removes routes from the DAPM context.

## Name

`snd_soc_dapm_weak_routes` — Mark routes between DAPM widgets as weak

## Synopsis

```
int snd_soc_dapm_weak_routes (struct snd_soc_dapm_context * dapm, const
struct snd_soc_dapm_route * route, int num);
```

## Arguments

*dapm*     DAPM context

*route*    audio routes

*num*       number of routes

## Description

Mark existing routes matching those specified in the passed array as being weak, meaning that they are ignored for the purpose of power decisions. The main intended use case is for sidetone paths which couple audio between other independent paths if they are both active in order to make the combination work better at the user level but which aren't intended to be “used”.

Note that CODEC drivers should not use this as sidetone type paths can frequently also be used as bypass paths.

## Name

`snd_soc_dapm_new_widgets` — add new dapm widgets

## Synopsis

```
int snd_soc_dapm_new_widgets (struct snd_soc_card * card);
```

## Arguments

*card*    card to be checked for new dapm widgets

## Description

Checks the codec for any new dapm widgets and creates them if found.

Returns 0 for success.

## Name

`snd_soc_dapm_get_volsw` — dapm mixer get callback

## Synopsis

```
int snd_soc_dapm_get_volsw (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to get the value of a dapm mixer control.

Returns 0 for success.

## Name

`snd_soc_dapm_put_volsw` — dapm mixer set callback

## Synopsis

```
int snd_soc_dapm_put_volsw (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to set the value of a dapm mixer control.

Returns 0 for success.

## Name

`snd_soc_dapm_get_enum_double` — dapm enumerated double mixer get callback

## Synopsis

```
int snd_soc_dapm_get_enum_double (struct snd_kcontrol * kcontrol, struct
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to get the value of a dapm enumerated double mixer control.

Returns 0 for success.

## Name

`snd_soc_dapm_put_enum_double` — dapm enumerated double mixer set callback

## Synopsis

```
int snd_soc_dapm_put_enum_double (struct snd_kcontrol * kcontrol, struct  
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol* mixer control

*ucontrol* control element information

## Description

Callback to set the value of a dapm enumerated double mixer control.

Returns 0 for success.

## Name

`snd_soc_dapm_info_pin_switch` — Info for a pin switch

## Synopsis

```
int snd_soc_dapm_info_pin_switch (struct snd_kcontrol * kcontrol, struct  
snd_ctl_elem_info * uinfo);
```

## Arguments

*kcontrol*    mixer control

*uinfo*       control element information

## Description

Callback to provide information about a pin switch control.

## Name

`snd_soc_dapm_get_pin_switch` — Get information for a pin switch

## Synopsis

```
int snd_soc_dapm_get_pin_switch (struct snd_kcontrol * kcontrol, struct  
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol*   mixer control

*ucontrol*   Value

## Name

`snd_soc_dapm_put_pin_switch` — Set information for a pin switch

## Synopsis

```
int snd_soc_dapm_put_pin_switch (struct snd_kcontrol * kcontrol, struct  
snd_ctl_elem_value * ucontrol);
```

## Arguments

*kcontrol*   mixer control

*ucontrol*   Value

## Name

`snd_soc_dapm_new_controls` — create new dapm controls

## Synopsis

```
int snd_soc_dapm_new_controls (struct snd_soc_dapm_context * dapm, const
struct snd_soc_dapm_widget * widget, int num);
```

## Arguments

*dapm*     DAPM context

*widget*   widget array

*num*     number of widgets

## Description

Creates new DAPM controls based upon the templates.

Returns 0 for success else error.

## Name

`snd_soc_dapm_enable_pin_unlocked` — enable pin.

## Synopsis

```
int snd_soc_dapm_enable_pin_unlocked (struct snd_soc_dapm_context *  
dapm, const char * pin);
```

## Arguments

*dapm* DAPM context

*pin* pin name

## Description

Enables input/output pin and its parents or children widgets iff there is a valid audio route and active audio stream.

Requires external locking.

## NOTE

`snd_soc_dapm_sync` needs to be called after this for DAPM to do any widget power switching.

## Name

`snd_soc_dapm_enable_pin` — enable pin.

## Synopsis

```
int snd_soc_dapm_enable_pin (struct snd_soc_dapm_context * dapm, const  
char * pin);
```

## Arguments

*dapm*    DAPM context

*pin*     pin name

## Description

Enables input/output pin and its parents or children widgets iff there is a valid audio route and active audio stream.

## NOTE

`snd_soc_dapm_sync` needs to be called after this for DAPM to do any widget power switching.

## Name

`snd_soc_dapm_force_enable_pin_unlocked` — force a pin to be enabled

## Synopsis

```
int snd_soc_dapm_force_enable_pin_unlocked (struct snd_soc_dapm_context
* dapm, const char * pin);
```

## Arguments

*dapm*    DAPM context

*pin*     pin name

## Description

Enables input/output pin regardless of any other state. This is intended for use with microphone bias supplies used in microphone jack detection.

Requires external locking.

## NOTE

`snd_soc_dapm_sync` needs to be called after this for DAPM to do any widget power switching.

## Name

`snd_soc_dapm_force_enable_pin` — force a pin to be enabled

## Synopsis

```
int snd_soc_dapm_force_enable_pin (struct snd_soc_dapm_context * dapm,  
const char * pin);
```

## Arguments

*dapm*    DAPM context

*pin*     pin name

## Description

Enables input/output pin regardless of any other state. This is intended for use with microphone bias supplies used in microphone jack detection.

## NOTE

`snd_soc_dapm_sync` needs to be called after this for DAPM to do any widget power switching.

## Name

`snd_soc_dapm_disable_pin_unlocked` — disable pin.

## Synopsis

```
int snd_soc_dapm_disable_pin_unlocked (struct snd_soc_dapm_context *  
dapm, const char * pin);
```

## Arguments

*dapm* DAPM context

*pin* pin name

## Description

Disables input/output pin and its parents or children widgets.

Requires external locking.

## NOTE

`snd_soc_dapm_sync` needs to be called after this for DAPM to do any widget power switching.

## Name

`snd_soc_dapm_disable_pin` — disable pin.

## Synopsis

```
int snd_soc_dapm_disable_pin (struct snd_soc_dapm_context * dapm, const
char * pin);
```

## Arguments

*dapm*    DAPM context

*pin*     pin name

## Description

Disables input/output pin and its parents or children widgets.

## NOTE

`snd_soc_dapm_sync` needs to be called after this for DAPM to do any widget power switching.

## Name

`snd_soc_dapm_nc_pin_unlocked` — permanently disable pin.

## Synopsis

```
int snd_soc_dapm_nc_pin_unlocked (struct snd_soc_dapm_context * dapm,  
const char * pin);
```

## Arguments

*dapm*    DAPM context

*pin*     pin name

## Description

Marks the specified pin as being not connected, disabling it along any parent or child widgets. At present this is identical to `snd_soc_dapm_disable_pin` but in future it will be extended to do additional things such as disabling controls which only affect paths through the pin.

Requires external locking.

## NOTE

`snd_soc_dapm_sync` needs to be called after this for DAPM to do any widget power switching.

## Name

`snd_soc_dapm_nc_pin` — permanently disable pin.

## Synopsis

```
int snd_soc_dapm_nc_pin (struct snd_soc_dapm_context * dapm, const char  
* pin);
```

## Arguments

*dapm*    DAPM context

*pin*     pin name

## Description

Marks the specified pin as being not connected, disabling it along any parent or child widgets. At present this is identical to `snd_soc_dapm_disable_pin` but in future it will be extended to do additional things such as disabling controls which only affect paths through the pin.

## NOTE

`snd_soc_dapm_sync` needs to be called after this for DAPM to do any widget power switching.

## Name

`snd_soc_dapm_get_pin_status` — get audio pin status

## Synopsis

```
int snd_soc_dapm_get_pin_status (struct snd_soc_dapm_context * dapm,  
const char * pin);
```

## Arguments

*dapm*    DAPM context

*pin*     audio signal pin endpoint (or start point)

## Description

Get audio pin status - connected or disconnected.

Returns 1 for connected otherwise 0.

## Name

`snd_soc_dapm_ignore_suspend` — ignore suspend status for DAPM endpoint

## Synopsis

```
int snd_soc_dapm_ignore_suspend (struct snd_soc_dapm_context * dapm,  
const char * pin);
```

## Arguments

*dapm*    DAPM context

*pin*     audio signal pin endpoint (or start point)

## Description

Mark the given endpoint or pin as ignoring suspend. When the system is disabled a path between two endpoints flagged as ignoring suspend will not be disabled. The path must already be enabled via normal means at suspend time, it will not be turned on if it was not already enabled.

## Name

`snd_soc_dapm_free` — free dapm resources

## Synopsis

```
void snd_soc_dapm_free (struct snd_soc_dapm_context * dapm);
```

## Arguments

*dapm*    DAPM context

## Description

Free all dapm widgets and resources.

# ASoC DMA Engine API

## Name

`snd_dmaengine_pcm_prepare_slave_config` — Generic `prepare_slave_config` callback

## Synopsis

```
int snd_dmaengine_pcm_prepare_slave_config (struct snd_pcm_substream *  
    substream, struct snd_pcm_hw_params * params, struct dma_slave_config  
    * slave_config);
```

## Arguments

|                     |                             |
|---------------------|-----------------------------|
| <i>substream</i>    | PCM substream               |
| <i>params</i>       | hw_params                   |
| <i>slave_config</i> | DMA slave config to prepare |

## Description

This function can be used as a generic `prepare_slave_config` callback for platforms which make use of the `snd_dmaengine_dai_dma_data` struct for their DAI DMA data. Internally the function will first call `snd_hwparams_to_dma_slave_config` to fill in the slave config based on the `hw_params`, followed by `snd_dmaengine_set_config_from_dai_data` to fill in the remaining fields based on the DAI DMA data.

## Name

`snd_dmaengine_pcm_register` — Register a dmaengine based PCM device

## Synopsis

```
int snd_dmaengine_pcm_register (struct device * dev, const struct  
snd_dmaengine_pcm_config * config, unsigned int flags);
```

## Arguments

*dev*      The parent device for the PCM device

*config*   Platform specific PCM configuration

*flags*    Platform specific quirks

## Name

`snd_dmaengine_pcm_unregister` — Removes a dmaengine based PCM device

## Synopsis

```
void snd_dmaengine_pcm_unregister (struct device * dev);
```

## Arguments

*dev* Parent device the PCM was register with

## Description

Removes a dmaengine based PCM device previously registered with `snd_dmaengine_pcm_register`.

---

# **Chapter 8. Miscellaneous Functions**

## **Hardware-Dependent Devices API**

## Name

`snd_hwdep_new` — create a new hwdep instance

## Synopsis

```
int snd_hwdep_new (struct snd_card * card, char * id, int device, struct
snd_hwdep ** rhwdep);
```

## Arguments

*card*      the card instance

*id*        the id string

*device*   the device index (zero-based)

*rhwdep*   the pointer to store the new hwdep instance

## Description

Creates a new hwdep instance with the given index on the card. The callbacks (`hwdep->ops`) must be set on the returned instance after this call manually by the caller.

## Return

Zero if successful, or a negative error code on failure.

# Jack Abstraction Layer API

## Name

enum snd\_jack\_types — Jack types which can be reported

## Synopsis

```
enum snd_jack_types {
    SND_JACK_HEADPHONE,
    SND_JACK_MICROPHONE,
    SND_JACK_HEADSET,
    SND_JACK_LINEOUT,
    SND_JACK_MECHANICAL,
    SND_JACK_VIDEOOUT,
    SND_JACK_AVOUT,
    SND_JACK_LINEIN,
    SND_JACK_BTN_0,
    SND_JACK_BTN_1,
    SND_JACK_BTN_2,
    SND_JACK_BTN_3,
    SND_JACK_BTN_4,
    SND_JACK_BTN_5
};
```

## Constants

|                     |                      |
|---------------------|----------------------|
| SND_JACK_HEADPHONE  | Headphone            |
| SND_JACK_MICROPHONE | Microphone           |
| SND_JACK_HEADSET    | Headset              |
| SND_JACK_LINEOUT    | Line out             |
| SND_JACK_MECHANICAL | Mechanical switch    |
| SND_JACK_VIDEOOUT   | Video out            |
| SND_JACK_AVOUT      | AV (Audio Video) out |
| SND_JACK_LINEIN     | Line in              |
| SND_JACK_BTN_0      | Button 0             |
| SND_JACK_BTN_1      | Button 1             |
| SND_JACK_BTN_2      | Button 2             |
| SND_JACK_BTN_3      | Button 3             |
| SND_JACK_BTN_4      | Button 4             |
| SND_JACK_BTN_5      | Button 5             |

## Description

These values are used as a bitmask.

Note that this must be kept in sync with the lookup table in `sound/core/jack.c`.

## Name

`snd_jack_add_new_kctl` — Create a new `snd_jack_kctl` and add it to `jack`

## Synopsis

```
int snd_jack_add_new_kctl (struct snd_jack * jack, const char * name,  
int mask);
```

## Arguments

*jack* the jack instance which the kctl will attaching to

*name* the name for the `snd_kcontrol` object

*mask* a bitmask of enum `snd_jack_type` values that can be detected by this `snd_jack_kctl` object.

## Description

Creates a new `snd_kcontrol` object and adds it to the `jack kctl_list`.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_jack_new` — Create a new jack

## Synopsis

```
int snd_jack_new (struct snd_card * card, const char * id, int type,  
struct snd_jack ** jjack, bool initial_kctl, bool phantom_jack);
```

## Arguments

|                     |                                                                                       |
|---------------------|---------------------------------------------------------------------------------------|
| <i>card</i>         | the card instance                                                                     |
| <i>id</i>           | an identifying string for this jack                                                   |
| <i>type</i>         | a bitmask of enum <code>snd_jack_type</code> values that can be detected by this jack |
| <i>jjack</i>        | Used to provide the allocated jack object to the caller.                              |
| <i>initial_kctl</i> | if true, create a kcontrol and add it to the jack list.                               |
| <i>phantom_jack</i> | Don't create a input device for phantom jacks.                                        |

## Description

Creates a new jack object.

## Return

Zero if successful, or a negative error code on failure. On success *jjack* will be initialised.

## Name

`snd_jack_set_parent` — Set the parent device for a jack

## Synopsis

```
void snd_jack_set_parent (struct snd_jack * jack, struct device * parent);
```

## Arguments

*jack*      The jack to configure

*parent*    The device to set as parent for the jack.

## Description

Set the parent for the jack devices in the device tree. This function is only valid prior to registration of the jack. If no parent is configured then the parent device will be the sound card.

## Name

`snd_jack_set_key` — Set a key mapping on a jack

## Synopsis

```
int snd_jack_set_key (struct snd_jack * jack, enum snd_jack_types type,  
int keytype);
```

## Arguments

*jack*        The jack to configure

*type*        Jack report type for this key

*keytype*    Input layer key type to be reported

## Description

Map a `SND_JACK_BTN_` button type to an input layer key, allowing reporting of keys on accessories via the jack abstraction. If no mapping is provided but keys are enabled in the jack type then `BTN_n` numeric buttons will be reported.

If jacks are not reporting via the input API this call will have no effect.

Note that this is intended to be use by simple devices with small numbers of keys that can be reported. It is also possible to access the input device directly - devices with complex input capabilities on accessories should consider doing this rather than using this abstraction.

This function may only be called prior to registration of the jack.

## Return

Zero if successful, or a negative error code on failure.

## Name

`snd_jack_report` — Report the current status of a jack

## Synopsis

```
void snd_jack_report (struct snd_jack * jack, int status);
```

## Arguments

*jack*     The jack to report status for

*status*   The current status of the jack

## Name

`snd_soc_card_jack_new` — Create a new jack

## Synopsis

```
int snd_soc_card_jack_new (struct snd_soc_card * card, const char * id,
int type, struct snd_soc_jack * jack, struct snd_soc_jack_pin * pins,
unsigned int num_pins);
```

## Arguments

|                 |                                                                                           |
|-----------------|-------------------------------------------------------------------------------------------|
| <i>card</i>     | ASoC card                                                                                 |
| <i>id</i>       | an identifying string for this jack                                                       |
| <i>type</i>     | a bitmask of enum <code>snd_soc_jack_type</code> values that can be detected by this jack |
| <i>jack</i>     | structure to use for the jack                                                             |
| <i>pins</i>     | Array of jack pins to be added to the jack or NULL                                        |
| <i>num_pins</i> | Number of elements in the <i>pins</i> array                                               |

## Description

Creates a new jack object.

Returns zero if successful, or a negative error code on failure. On success jack will be initialised.

## Name

`snd_soc_jack_report` — Report the current status for a jack

## Synopsis

```
void snd_soc_jack_report (struct snd_soc_jack * jack, int status, int  
mask);
```

## Arguments

*jack*      the jack

*status*    a bitmask of enum `snd_jack_type` values that are currently detected.

*mask*      a bitmask of enum `snd_jack_type` values that being reported.

## Description

If configured using `snd_soc_jack_add_pins` then the associated DAPM pins will be enabled or disabled as appropriate and DAPM synchronised.

## Note

This function uses mutexes and should be called from a context which can sleep (such as a workqueue).

## Name

`snd_soc_jack_add_zones` — Associate voltage zones with jack

## Synopsis

```
int snd_soc_jack_add_zones (struct snd_soc_jack * jack, int count,  
struct snd_soc_jack_zone * zones);
```

## Arguments

*jack*    ASoC jack

*count*   Number of zones

*zones*   Array of zones

## Description

After this function has been called the zones specified in the array will be associated with the jack.

## Name

`snd_soc_jack_get_type` — Based on the mic bias value, this function returns the type of jack from the zones declared in the jack type

## Synopsis

```
int  snd_soc_jack_get_type (struct  snd_soc_jack  *  jack,  int
micbias_voltage);
```

## Arguments

*jack*                      ASoC jack

*micbias\_voltage*   mic bias voltage at adc channel when jack is plugged in

## Description

Based on the mic bias value passed, this function helps identify the type of jack from the already declared jack zones

## Name

`snd_soc_jack_add_pins` — Associate DAPM pins with an ASoC jack

## Synopsis

```
int snd_soc_jack_add_pins (struct snd_soc_jack * jack, int count, struct  
snd_soc_jack_pin * pins);
```

## Arguments

*jack*    ASoC jack

*count*   Number of pins

*pins*    Array of pins

## Description

After this function has been called the DAPM pins specified in the pins array will have their status updated to reflect the current state of the jack whenever the jack status is updated.

## Name

`snd_soc_jack_notifier_register` — Register a notifier for jack status

## Synopsis

```
void snd_soc_jack_notifier_register (struct snd_soc_jack * jack, struct  
notifier_block * nb);
```

## Arguments

*jack*    ASoC jack

*nb*      Notifier block to register

## Description

Register for notification of the current status of the jack. Note that it is not possible to report additional jack events in the callback from the notifier, this is intended to support applications such as enabling electrical detection only when a mechanical detection event has occurred.

## Name

`snd_soc_jack_notifier_unregister` — Unregister a notifier for jack status

## Synopsis

```
void snd_soc_jack_notifier_unregister (struct snd_soc_jack * jack,  
struct notifier_block * nb);
```

## Arguments

*jack*    ASoC jack

*nb*      Notifier block to unregister

## Description

Stop notifying for status changes.

## Name

`snd_soc_jack_add_gpios` — Associate GPIO pins with an ASoC jack

## Synopsis

```
int snd_soc_jack_add_gpios (struct snd_soc_jack * jack, int count,  
struct snd_soc_jack_gpio * gpios);
```

## Arguments

*jack*    ASoC jack

*count*   number of pins

*gpios*   array of gpio pins

## Description

This function will request gpio, set data direction and request irq for each gpio in the array.

## Name

`snd_soc_jack_add_gpiods` — Associate GPIO descriptor pins with an ASoC jack

## Synopsis

```
int snd_soc_jack_add_gpiods (struct device * gpiod_dev, struct
snd_soc_jack * jack, int count, struct snd_soc_jack_gpio * gpios);
```

## Arguments

*gpiod\_dev*    GPIO consumer device

*jack*        ASoC jack

*count*       number of pins

*gpios*       array of gpio pins

## Description

This function will request gpio, set data direction and request irq for each gpio in the array.

## Name

`snd_soc_jack_free_gpios` — Release GPIO pins' resources of an ASoC jack

## Synopsis

```
void snd_soc_jack_free_gpios (struct snd_soc_jack * jack, int count,  
struct snd_soc_jack_gpio * gpios);
```

## Arguments

*jack*    ASoC jack

*count*   number of pins

*gpios*   array of gpio pins

## Description

Release gpio and irq resources for gpio pins associated with an ASoC jack.

# ISA DMA Helpers

## Name

`snd_dma_program` — program an ISA DMA transfer

## Synopsis

```
void snd_dma_program (unsigned long dma, unsigned long addr, unsigned  
int size, unsigned short mode);
```

## Arguments

*dma* the dma number

*addr* the physical address of the buffer

*size* the DMA transfer size

*mode* the DMA transfer mode, `DMA_MODE_XXX`

## Description

Programs an ISA DMA transfer for the given buffer.

## Name

`snd_dma_disable` — stop the ISA DMA transfer

## Synopsis

```
void snd_dma_disable (unsigned long dma);
```

## Arguments

*dma*    the dma number

## Description

Stops the ISA DMA transfer.

## Name

`snd_dma_pointer` — return the current pointer to DMA transfer buffer in bytes

## Synopsis

```
unsigned int snd_dma_pointer (unsigned long dma, unsigned int size);
```

## Arguments

*dma*     the dma number

*size*    the dma transfer size

## Return

The current pointer in DMA transfer buffer in bytes.

## Other Helper Macros

## Name

`snd_printk` — printk wrapper

## Synopsis

```
snd_printk ( fmt, args... );
```

## Arguments

*fmt*            format string

*args...*      variable arguments

## Description

Works like `printk` but prints the file and the line of the caller when configured with `CONFIG_SND_VERBOSE_PRINTK`.

## Name

`snd_printd` — debug printk

## Synopsis

```
snd_printd ( fmt, args... );
```

## Arguments

*fmt*            format string

*args...*    variable arguments

## Description

Works like `snd_printk` for debugging purposes. Ignored when `CONFIG_SND_DEBUG` is not set.

## Name

snd\_DEBUG — give a BUG warning message and stack trace

## Synopsis

```
snd_DEBUG (void);
```

## Arguments

None

## Description

Calls WARN if CONFIG\_SND\_DEBUG is set. Ignored when CONFIG\_SND\_DEBUG is not set.

## Name

`snd_printd_ratelimit` —

## Synopsis

```
snd_printd_ratelimit (void);
```

## Arguments

None

## Name

`snd_DEBUG_ON` — debugging check macro

## Synopsis

```
snd_DEBUG_ON ( cond );
```

## Arguments

*cond*    condition to evaluate

## Description

Has the same behavior as `WARN_ON` when `CONFIG_SND_DEBUG` is set, otherwise just evaluates the conditional and returns the value.

## Name

snd\_printdd — debug printk

## Synopsis

```
snd_printdd ( format, args...);
```

## Arguments

*format*     format string

*args...*   variable arguments

## Description

Works like `snd_printk` for debugging purposes. Ignored when `CONFIG_SND_DEBUG_VERBOSE` is not set.