

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, <code>SNDRV_DEV_XXX</code>
<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 sub-  
stream_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_in-  
terval * 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, unsigned 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>i</i>	the interval value to refine
<i>count</i>	the number of elements in the list
<i>list</i>	the value list
<i>mask</i>	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 <code>snd_ratnums</code> 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_s-  
frames_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

<i>runtime</i>	PCM runtime instance
<i>var</i>	The hw_params variable to constrain
<i>val</i>	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

<i>substream</i>	PCM substream
<i>ofs</i>	byte offset
<i>size</i>	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*.

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

substream PCM substream

dma_data DAI DMA data

slave_config 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 `addr_width` field of the DAI DMA data struct is not equal to `DMA_SLAVE_BUSWIDTH_UNDEFINED`.

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;  
};
```

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

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_runtime *runtime);
    struct dma_chan *(* compat_request_channel) (struct snd_soc_pcm_runtime *rtd, struct snd_pcm_substream *substream);
    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-ioctls

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
snd_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 pcm-  
s_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_TLVT_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

<i>kcontrol</i>	vmaster kctl element
<i>hook</i>	the hook function
<i>private_data</i>	the <i>private_data</i> 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 codec capability descriptor

Name

enum sndrv_compress_encoder —

Synopsis

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

Constants

SNDRV_COMPRESS_ENCODER_PADDING	no of samples appended by the encoder at the end of the track
SNDRV_COMPRESS_ENCODER_DELAY	no of 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

`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](http://flac.sourceforge.net/documentation_tools_flac.html)

[//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;
    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
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;
};
```

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_com-  
ponent * 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_con-  
text * 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_dap-  
m_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

Returns

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_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 * component,  
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_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

<i>dev</i>	The parent device for the platform
<i>platform</i>	The platform to add
<i>platform_drv</i>	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

<i>dev</i>	The parent device for this codec
<i>codec_drv</i>	Codec driver
<i>dai_drv</i>	The associated DAI driver
<i>num_dai</i>	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

<i>component</i>	Component to write to
<i>reg</i>	Register to write
<i>val</i>	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.

