



Embedded Linux Audio **Training lab book solutions**

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About this document

This document is part of an embedded Linux training from Free Electrons.

You will find the whole training materials (slides and lab book) on <http://free-electrons.com/training>

Lab data can be found on http://free-electrons.com/labs/embedded_linux.tar.bz2.

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Lab 1 – Playing sound with ALSA

Objective: get familiar with sound manipulation with ALSA

Setup

Go to `/mnt/labs/sound/lab1`

Add the below line to the `/etc/exports` file:

```
/mnt/labs/sound/lab1/newsroom 172.20.0.2(rw,no_root_squash,no_subtree_check)
```

Restart the NFS server to read this file again:

```
sudo /etc/init.d/nfs-kernel-server restart
```

Run a virtual PC

You just had to run the script present in the current directory:

```
./run_qemu
```

Create ALSA device files

The name of the sound card emulated by QEMU can be found in `/proc/asound/cards`:

```
0 [AudioPCI          ]: ENS1370 - Ensoniq AudioPCI
                          Ensoniq AudioPCI ENS1370 at 0xc200, irq 9
```

As explained in the slides, the devices in your sound card and the minor numbers that the kernel driver expects are found in `/proc/asound/devices`:

```
0: [ 0]    : control
8: [ 0- 0]: raw midi
16: [ 0- 0]: digital audio playback
17: [ 0- 1]: digital audio playback
24: [ 0- 0]: digital audio capture
33:       : timer
```

You just have to create the device files as follows:

```
mkdir /dev/snd
cd /dev/snd
mknod controlC0 c 116 0
mknod midiC0D0 c 116 8
mknod pcmC0D0p c 116 16
mknod pcmC0D1p c 116 17
mknod pcmC0D0c c 116 24
mknod timer c 116 33
```

As your filesystem already contains ALSA libraries, utilities and compatible players, you're ready to play sound!

corresponding to the sound card in the emulated PC.

Play sound samples

Go to the `/samples` directory. Here is an example playing a sound sample:

```
aplay rooster.wav
```

Naming your sound card

As explained in the lectures, you can call your sound card “`ensoniq`” by creating a



/etc/asound.conf file with the below lines:

```
pcm.ensoniq {
    type hw
    card 0
    device 0
}
```

You can now play sound with this card:

```
aplay -D ensoniq frog.wav
```

Sound mixing

Just reuse the examples given in the slides.

Adjusting the volume

You can do this with the `alsamixer` command, which we compiled from the `alsa-utils` sources.

It's the level of the PCM device that you should change. Unfortunately, this has no effect at the moment (we told you about this problem in the instructions).

Using other PCM plugins

Discard the sound output from your sound player. Let's use the `null` plugin:

```
aplay -D null hens.wav
```

Play a sound into a file, without playing it on the sound card. Let's use the `file` plugin:

```
aplay -D file:output.raw hens.wav
```

To play the raw output:

```
aplay -f cd output.raw
```

Unfortunately, only the raw format is supported at the moment, and you can't just play it without specifying a format. Otherwise, it seems that the sample rate doesn't correspond to the card capabilities and a wrong sample rate is chosen, and you just hear noise. Try by yourself, and see more details in the output of `aplay`.

With `-f cd`, we're choosing the `cd` format.

To play a sound into a file and play it on the sound card at the same time:

```
aplay -D tee:default,output.raw hens.wav
```

The `tee` plugin takes 2 parameters: a PCM device (`default` here, but it could have been `ensoniq`, for example, note that `hw:0,0` wouldn't work because it wouldn't be possible to distinguish the parameters of `hw` and `tee`), and an output file name.

Tee PCM device

Create a PCM device that plays sound on the default sound card, and dumps the audio into a file. This file should always have the same name.

You can reuse the example of the recorder PCM device given in the slides, using the `tee` plugin instead of the `file` one.

Add the below lines to `/etc/asound.conf`:

```
pcm.spy {
    type plug
    slave {
        pcm "tee:ensoniq,/spy.raw"
    }
}
```



```
}
```

Sound recording

Just reuse the example given in the slides:

```
arecord -f cd input.wav
```

Just play what you recorded with:

```
aplay input.wav
```



Lab 2 - Basic ALSA sound driver

Objective: Practice with the basic ALSA driver API

No solutions for this lab yet. Sorry!