Introduction  Notes on Modular Sound Drivers and Soundcore
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Purpose:
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This document provides some general notes on the modular
sound drivers and their configuration, along with the
support modules sound.o and soundcore.o.

Note, some of this probably should be added to the Sound-HOWTO!

Note, soundlow.o was present with 2.2 kernels but is not
required for 2.4.x kernels.  References have been removed
to this.

Copying:
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none

History:
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| | | |
|---|---|---|
| 0.1.0 | 11/20/1998 | First version, draft |
| 1.0.0 | 11/1998 | Alan Cox changes, incorporation in 2.2.0<br>as Documentation/sound/oss/Introduction |
| 1.1.0 | 6/30/1999 | Second version, added notes on making the drivers,<br>added info on multiple sound cards of similar types,]<br>added more diagnostics info, added info about esd.<br>added info on OSS and ALSA. |
| 1.1.1 | 19991031 | Added notes on sound-slot- and sound-service.<br>(Alan Cox) |
| 1.1.2 | 20000920 | Modified for Kernel 2.4 (Christoph Hellwig) |
| 1.1.3 | 20010214 | Minor notes and corrections (Wade Hampton)<br>Added examples of sound-slot-0, etc. |

Modular Sound Drivers:
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Thanks to the GREAT work by Alan Cox (alan@lxorguk.ukuu.org.uk),

[And Oleg Drokin, Thomas Sailer, Andrew Veliath and more than a few
 others - not to mention Hannu's original code being designed well
 enough to cope with that kind of chopping up](Alan)

the standard Linux kernels support a modular sound driver.  From
Alan's comments in linux/drivers/sound/README.FIRST:

  The modular sound driver patches were funded by Red Hat Software
  (www.redhat.com). The sound driver here is thus a modified version of
  Hannu's code. Please bear that in mind when considering the appropriate
  forums for bug reporting.

The modular sound drivers may be loaded via insmod or modprobe.

To support all the various sound modules, there are two general support modules that must be loaded first:

| | |
|---|---|
| soundcore.o: | Top level handler for the sound system, provides a set of functions for registration of devices by type. |
| sound.o: | Common sound functions required by all modules. |

For the specific sound modules (e.g., sb.o for the Soundblaster), read the documentation on that module to determine what options are available, for example IRQ, address, DMA.

Warning, the options for different cards sometime use different names for the same or a similar feature (dma1= versus dma16=). As a last resort, inspect the code (search for module_param).

Notes:

1. There is a new OpenSource sound driver called ALSA which is currently under development: http://www.alsa-project.org/ The ALSA drivers support some newer hardware that may not be supported by this sound driver and also provide some additional features.

2. The commercial OSS driver may be obtained from the site: http://www.opensound.com. This may be used for cards that are unsupported by the kernel driver, or may be used by other operating systems.

3. The enlightenment sound daemon may be used for playing multiple sounds at the same time via a single card, eliminating some of the requirements for multiple sound card systems. For more information, see: http://www.tux.org/~ricdude/EsounD.html The "esd" program may be used with the real-player and mpeg players like mpg123 and x11amp. The newer real-player and some games even include built-in support for ESD!

## Building the Modules:

This document does not provide full details on building the kernel, etc. The notes below apply only to making the kernel sound modules. If this conflicts with the kernel's README, the README takes precedence.

1. To make the kernel sound modules, cd to your /usr/src/linux directory (typically) and type make config, make menuconfig, or make xconfig (to start the command line, dialog, or x-based configuration tool).

2. Select the Sound option and a dialog will be displayed.

3. Select M (module) for "Sound card support".

4. Select your sound driver(s) as a module. For ProAudio, Sound Blaster, etc., select M (module) for OSS sound modules. [thanks to Marvin Stodolsky <stodolsk@erols.com>]A

5. Make the kernel (e.g., make bzImage), and install the kernel.

6. Make the modules and install them (make modules; make modules_install).

Note, for 2.5.x kernels, make sure you have the newer module-init-tools installed or modules will not be loaded properly. 2.5.x requires an updated module-init-tools.

Plug and Play (PnP:
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If the sound card is an ISA PnP card, isapnp may be used to configure the card. See the file isapnp.txt in the directory one level up (e.g., /usr/src/linux/Documentation).

Also the 2.4.x kernels provide PnP capabilities, see the file NEWS in this directory.

PCI sound cards are highly recommended, as they are far easier to configure and from what I have read, they use less resources and are more CPU efficient.

INSMOD:
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If loading via insmod, the common modules must be loaded in the order below BEFORE loading the other sound modules. The card-specific modules may then be loaded (most require parameters). For example, I use the following via a shell script to load my SoundBlaster:

```
SB_BASE=0x240
SB_IRQ=9
SB_DMA=3
SB_DMA2=5
SB_MPU=0x300
#
echo Starting sound
/sbin/insmod soundcore
/sbin/insmod sound
#
echo Starting sound blaster....
/sbin/insmod uart401
/sbin/insmod sb io=$SB_BASE irq=$SB_IRQ dma=$SB_DMA dma16=$SB_DMA2 mpu_io=$SB_MP
```

When using sound as a module, I typically put these commands in a file such as /root/soundon.sh.

MODPROBE:
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If loading via modprobe, these common files are automatically loaded
when requested by modprobe.  For example, my /etc/modprobe.conf contains:

```
alias sound sb
options sb io=0x240 irq=9 dma=3 dma16=5 mpu_io=0x300
```

All you need to do to load the module is:

```
        /sbin/modprobe sb
```

Sound Status:
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The status of sound may be read/checked by:

```
        cat (anyfile).au >/dev/audio
```

[WWH:  This may not work properly for SoundBlaster PCI 128 cards
such as the es1370/1 (see the es1370/1 files in this directory)
as they do not automatically support uLaw on /dev/audio.]

The status of the modules and which modules depend on
which other modules may be checked by:

```
        /sbin/lsmod
```

/sbin/lsmod should show something like the following:

```
        sb                     26280   0
        uart401                 5640   0  [sb]
        sound                  57112   0  [sb uart401]
        soundcore               1968   8  [sb sound]
```

Removing Sound:
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Sound may be removed by using /sbin/rmmod in the reverse order
in which you load the modules.  Note, if a program has a sound device
open (e.g., xmixer), that module (and the modules on which it
depends) may not be unloaded.

For example, I use the following to remove my Soundblaster (rmmod
in the reverse order in which I loaded the modules):

```
/sbin/rmmod sb
/sbin/rmmod uart401
/sbin/rmmod sound
/sbin/rmmod soundcore
```

When using sound as a module, I typically put these commands
in a script such as /root/soundoff.sh.

Removing Sound for use with OSS:
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If you get really stuck or have a card that the kernel modules will not support, you can get a commercial sound driver from http://www.opensound.com. Before loading the commercial sound driver, you should do the following:

1. remove sound modules (detailed above)
2. remove the sound modules from /etc/modprobe.conf
3. move the sound modules from /lib/modules/<kernel>/misc (for example, I make a /lib/modules/<kernel>/misc/tmp directory and copy the sound module files to that directory).

Multiple Sound Cards:
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The sound drivers will support multiple sound cards and there are some great applications like multitrack that support them. Typically, you need two sound cards of different types. Note, this uses more precious interrupts and DMA channels and sometimes can be a configuration nightmare. I have heard reports of 3-4 sound cards (typically I only use 2). You can sometimes use multiple PCI sound cards of the same type.

On my machine I have two sound cards (cs4232 and Soundblaster Vibra 16). By loading sound as modules, I can control which is the first sound device (/dev/dsp, /dev/audio, /dev/mixer) and which is the second. Normally, the cs4232 (Dell sound on the motherboard) would be the first sound device, but I prefer the Soundblaster. All you have to do is to load the one you want as /dev/dsp first (in my case "sb") and then load the other one (in my case "cs4232").

If you have two cards of the same type that are jumpered cards or different PnP revisions, you may load the same module twice. For example, I have a SoundBlaster vibra 16 and an older SoundBlaster 16 (jumpers). To load the module twice, you need to do the following:

1. Copy the sound modules to a new name. For example sb.o could be copied (or symlinked) to sb1.o for the second SoundBlaster.

2. Make a second entry in /etc/modprobe.conf, for example, sound1 or sb1. This second entry should refer to the new module names for example sb1, and should include the I/O, etc. for the second sound card.

3. Update your soundon.sh script, etc.

Warning: I have never been able to get two PnP sound cards of the same type to load at the same time. I have tried this several times with the Soundblaster Vibra 16 cards. OSS has indicated that this is a PnP problem.... If anyone has any luck doing this, please send me an E-MAIL. PCI sound cards should not have this problem.a Since this was originally release, I have received a couple of

mails from people who have accomplished this!

NOTE: In Linux 2.4 the Sound Blaster driver (and only this one yet)
supports multiple cards with one module by default.
Read the file 'Soundblaster' in this directory for details.

Sound Problems:
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First RTFM (including the troubleshooting section
in the Sound-HOWTO).

1) If you are having problems loading the modules (for
example, if you get device conflict errors) try the
following:

A) If you have Win95 or NT on the same computer,
write down what addresses, IRQ, and DMA channels
those were using for the same hardware. You probably
can use these addresses, IRQs, and DMA channels.
You should really do this BEFORE attempting to get
sound working!

B) Check (cat) /proc/interrupts, /proc/ioports,
and /proc/dma. Are you trying to use an address,
IRQ or DMA port that another device is using?

C) Check (cat) /proc/isapnp

D) Inspect your /var/log/messages file. Often that will
indicate what IRQ or IO port could not be obtained.

E) Try another port or IRQ. Note this may involve
using the PnP tools to move the sound card to
another location. Sometimes this is the only way
and it is more or less trial and error.

2) If you get motor-boating (the same sound or part of a
sound clip repeated), you probably have either an IRQ
or DMA conflict. Move the card to another IRQ or DMA
port. This has happened to me when playing long files
when I had an IRQ conflict.

3. If you get dropouts or pauses when playing high sample
rate files such as using mpg123 or x11amp/xmms, you may
have too slow of a CPU and may have to use the options to
play the files at 1/2 speed. For example, you may use
the -2 or -4 option on mpg123. You may also get this
when trying to play mpeg files stored on a CD-ROM
(my Toshiba T8000 PII/366 sometimes has this problem).

4. If you get "cannot access device" errors, your /dev/dsp
files, etc. may be set to owner root, mode 600. You
may have to use the command:
chmod 666 /dev/dsp /dev/mixer /dev/audio

5. If you get "device busy" errors, another program has the sound device open. For example, if using the Enlightenment sound daemon "esd", the "esd" program has the sound device. If using "esd", please RTFM the docs on ESD. For example, esddsp <program> may be used to play files via a non-esd aware program.

6) Ask for help on the sound list or send E-MAIL to the sound driver author/maintainer.

7) Turn on debug in drivers/sound/sound_config.h (DEB, DDB, MDB).

8) If the system reports insufficient DMA memory then you may want to load sound with the "dmabufs=1" option. Or in /etc/conf.modules add

```
preinstall sound dmabufs=1
```

This makes the sound system allocate its buffers and hang onto them.

You may also set persistent DMA when building a 2.4.x kernel.

## Configuring Sound:

There are several ways of configuring your sound:

1) On the kernel command line (when using the sound driver(s) compiled in the kernel). Check the driver source and documentation for details.

2) On the command line when using insmod or in a bash script using command line calls to load sound.

3) In /etc/modprobe.conf when using modprobe.

4) Via Red Hat's GPL'd /usr/sbin/sndconfig program (text based).

5) Via the OSS soundconf program (with the commercial version of the OSS driver.

6) By just loading the module and let isapnp do everything relevant for you. This works only with a few drivers yet and - of course - only with isapnp hardware.

And I am sure, several other ways.

Anyone want to write a linuxconf module for configuring sound?

## Module Loading:

When a sound card is first referenced and sound is modular, the sound system will ask for the sound devices to be loaded. Initially it requests that

the driver for the sound system is loaded. It then will ask for sound-slot-0, where 0 is the first sound card. (sound-slot-1 the second and so on). Thus you can do

alias sound-slot-0 sb

To load a soundblaster at this point. If the slot loading does not provide the desired device - for example a soundblaster does not directly provide a midi synth in all cases then it will request "sound-service-0-n" where n is

0 Mixer

2 MIDI

3, 4 DSP audio

For example, I use the following to load my Soundblaster PCI 128 (ES 1371) card first, followed by my SoundBlaster Vibra 16 card, then by my TV card:

```
# Load the Soundblaster PCI 128 as /dev/dsp, /dev/dsp1, /dev/mixer
alias sound-slot-0 es1371

# Load the Soundblaster Vibra 16 as /dev/dsp2, /dev/mixer1
alias sound-slot-1 sb
options sb io=0x240 irq=5 dma=1 dma16=5 mpu_io=0x330

# Load the BTTV (TV card) as /dev/mixer2
alias sound-slot-2 bttv
alias sound-service-2-0 tvmixer

pre-install bttv  modprobe tuner ; modprobe tvmixer
pre-install tvmixer modprobe msp3400; modprobe tvaudio
options tuner debug=0 type=8
options bttv  card=0 radio=0 pll=0
```

For More Information (RTFM):
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1) Information on kernel modules: manual pages for insmod and modprobe.

2) Information on PnP, RTFM manual pages for isapnp.

3) Sound-HOWTO and Sound-Playing-HOWTO.

4) OSS's WWW site at http://www.opensound.com.

5) All the files in Documentation/sound.

6) The comments and code in linux/drivers/sound.

7) The sndconfig and rhsound documentation from Red Hat.

8) The Linux-sound mailing list: sound-list@redhat.com.

9) Enlightenment documentation (for info on esd)
   http://www.tux.org/~ricdude/EsounD.html.

10) ALSA home page: http://www.alsa-project.org/

Contact Information:
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