关于gst\_element\_set\_state关闭声卡deadlock调查

## ■现象

gst\_element\_set\_state变更GST\_STATE\_NULL状态时deadlock。

## ■再现步骤

1.Carlife语音识别时说"鲜花"

2.在VR语音提示音的时候播放过程中，按radio硬按键切源

**更普遍的再现方法**：

**(也就是说该问题是普遍性问题，与Carlife无直接关系)**

1.插入U盘播放音乐

2.音乐播放过程中，点击暂停

3.使用gst-launch-1.0 playbin uri=file:///media/disk/Track02.mp3 播放音乐

4.步骤3音乐播放过程中按radio硬按键切源

5.按Ctrl+C 结束步骤3的音乐播放，发现无法结束，终端输出以下内容后hangup。

Setting pipeline to PAUSED ...

## ■直接原因

调用gst\_element\_set\_state()函数暂停播放时会调用到alsasink的gst\_alsasink\_reset()函数来重置PCM流，该函数会获取alsa\_lock锁，以保证当前正在处理的Buffer中的数据处理结束后重置PCM流。

由于alsasink的gst\_alsasink\_write()函数获取alsa\_lock锁之后，无法写入最后一包数据，导致该锁无法释放，最终导致gst\_element\_set\_state()死锁。

也就是说问题发生的时候，声卡的文件句柄无法正常写入。



err = snd\_pcm\_writei()的返回值是：-11。

snd\_strerror(err)打印出来的含义是："Resource temporarily unavailable"。

## ■根本原因

切源的时候DSP那边通路被切走，导致alsa的最后一包数据写不进去。

此时可以关声卡，但是不能写入数据。通路再切回来就能正常写入，声卡就可以关闭结束。

## ■调查详细

### 1）由于Carlife服务线程较多，为了准确定位是哪个线程，设置了线程名"SetNameForA7"

(gdb) info threads

Id Target Id Frame

15 Thread 0xb6588450 (LWP 2718) "SetNameForA7" 0xb6f6e6ee in recv () ★

at ../sysdeps/unix/syscall-template.S:81

14 Thread 0xb5d88450 (LWP 2719) "CarlifeDaemon" \_\_libc\_do\_syscall ()

at ../ports/sysdeps/unix/sysv/linux/arm/libc-do-syscall.S:43

...略...

2 Thread 0xae47a450 (LWP 2993) "TinyVpuDec:src" \_\_libc\_do\_syscall ()

at ../ports/sysdeps/unix/sysv/linux/arm/libc-do-syscall.S:43

\* 1 Thread 0xb658a000 (LWP 2717) "CarlifeDaemon" \_\_libc\_do\_syscall ()

at ../ports/sysdeps/unix/sysv/linux/arm/libc-do-syscall.S:43

★处是我们要找的"SetNameForA7"线程

### 2）正常情况下线程2718的状态

(gdb) thread 18

[Switching to thread 18 (Thread 0xb6588450 (LWP 2718))]

#0 0xb6f6e6ee in recv () at ../sysdeps/unix/syscall-template.S:81

81 ../sysdeps/unix/syscall-template.S: No such file or directory.

(gdb) bt

#0 0xb6f6e6ee in recv () at ../sysdeps/unix/syscall-template.S:81

#1 0xb6e64f64 in Socket::recv(unsigned char\*, unsigned int) const ()

from /usr/app/carlife/lib/libcarlifevehicle.so

#2 0xb6e639fa in CConnectManager::readCmdData(unsigned char\*, unsigned int) ()

from /usr/app/carlife/lib/libcarlifevehicle.so

...略...

#10 0xb6d54ee4 in ?? () from /usr/app/carlife/lib/libboost\_thread.so.1.59.0

#11 0xb6f6845e in start\_thread (arg=0xb6588910) at pthread\_create.c:314

#12 0xb6905d9c in ?? ()

at ../ports/sysdeps/unix/sysv/linux/arm/nptl/../clone.S:92

from /lib/arm-linux-gnueabihf/libc.so.6

Backtrace stopped: previous frame identical to this frame (corrupt stack?)

该线程用于接收来自手机Carlife的命令通道的消息，recv是阻塞式函数，无消息时阻塞在recv处，属于正常情况。

### 3）出问题的时候，线程2718的状态

(gdb) thread 17

[Switching to thread 17 (Thread 0xb6588450 (LWP 2718))]

#0 \_\_libc\_do\_syscall ()

at ../ports/sysdeps/unix/sysv/linux/arm/libc-do-syscall.S:43

43 in ../ports/sysdeps/unix/sysv/linux/arm/libc-do-syscall.S

(gdb) bt

#0 \_\_libc\_do\_syscall ()

at ../ports/sysdeps/unix/sysv/linux/arm/libc-do-syscall.S:43

#1 0xb6f6dffc in \_\_lll\_lock\_wait (futex=futex@entry=0x835fd8, private=0)

at ../ports/sysdeps/unix/sysv/linux/arm/nptl/lowlevellock.c:46

#2 0xb6f6a3aa in \_\_GI\_\_\_pthread\_mutex\_lock (mutex=0x835fd8)

at pthread\_mutex\_lock.c:134

#3 0xb6b88de2 in g\_mutex\_lock () from /usr/lib/libglib-2.0.so.0

#4 0xae4e56a2 in ?? () from /usr/lib/gstreamer-1.0/libgstalsa.so

Backtrace stopped: previous frame identical to this frame (corrupt stack?)

可以看出是libgstalsa.so中获取互斥锁的地方deadlock了，此时由于gstreamer的调试信息未打开，所以无法看到完整的调用关系。

### 4）重新编译gstreamer1.0-plugins-base插件，加-g参数增加调试信息，重新打印堆栈回溯

(gdb) bt

#0 \_\_libc\_do\_syscall ()

at ../ports/sysdeps/unix/sysv/linux/arm/libc-do-syscall.S:43

#1 0xb6eb0ffc in \_\_lll\_lock\_wait (futex=futex@entry=0x1fe0f30, private=0)

at ../ports/sysdeps/unix/sysv/linux/arm/nptl/lowlevellock.c:46

#2 0xb6ead3aa in \_\_GI\_\_\_pthread\_mutex\_lock (mutex=0x1fe0f30)

at pthread\_mutex\_lock.c:134

#3 0xb6acbde2 in g\_mutex\_lock () from /usr/lib/libglib-2.0.so.0

#4 0xac4b86a2 in gst\_alsasink\_reset (asink=0x1fcede8)

at /workspace/MR3/F516/poky/build/tmp/work/atlas7\_arm-poky-linux-gnueabi/gstreamer1.0-plugins-base/1.6-r0/git/ext/alsa/gstalsasink.c:1122

#5 0xb03a3a1a in gst\_audio\_sink\_ring\_buffer\_pause (buf=<optimized out>)

at /workspace/MR3/F516/poky/build/tmp/work/atlas7\_arm-poky-linux-gnueabi/gstreamer1.0-plugins-base/1.6-r0/git/gst-libs/gst/audio/gstaudiosink.c:545

#6 0xb0387082 in gst\_audio\_ring\_buffer\_pause\_unlocked (

buf=buf@entry=0x1fd4388)

at /workspace/MR3/F516/poky/build/tmp/work/atlas7\_arm-poky-linux-gnueabi/gstreamer1.0-plugins-base/1.6-r0/git/gst-libs/gst/audio/gstaudioringbuffer.c:1006

#7 0xb038966c in gst\_audio\_ring\_buffer\_pause (buf=0x1fd4388)

at /workspace/MR3/F516/poky/build/tmp/work/atlas7\_arm-poky-linux-gnueabi/gstreamer1.0-plugins-base/1.6-r0/git/gst-libs/gst/audio/gstaudioringbuffer.c:1049

#8 0xb03a0746 in gst\_audio\_base\_sink\_change\_state (element=0x1fcede8,

transition=GST\_STATE\_CHANGE\_PLAYING\_TO\_PAUSED)

at /workspace/MR3/F516/poky/build/tmp/work/atlas7\_arm-poky-linux-gnueabi/gst---Type <return> to continue, or q <return> to quit---

reamer1.0-plugins-base/1.6-r0/git/gst-libs/gst/audio/gstaudiobasesink.c:2471

#9 0xb6702ba2 in gst\_element\_change\_state ()

from /usr/lib/libgstreamer-1.0.so.0

#10 0xb6703004 in ?? () from /usr/lib/libgstreamer-1.0.so.0

Backtrace stopped: previous frame identical to this frame (corrupt stack?)

此时可以看出完整的Gstreamer设置管道状态的调用顺序。

### 5）通过阅读alsasink插件的代码,发现只有gst\_alsasink\_write()，gst\_alsasink\_reset()两个函数会获取alsa\_lock锁。

通过代码分析，唯一可能的原因是gst\_alsasink\_write()中调用snd\_pcm\_writei()函数一直失败。

### 6）使用" export GST\_DEBUG=3,alsa:7"打开alsa插件的日志，下面的日志证实了步骤5）的猜想。



## ■附录：

下面是gst\_alsasink\_write()和gst\_alsasink\_reset()函数的代码。

|  |
| --- |
| **static** **void**  gst\_alsasink\_reset **(**GstAudioSink **\*** asink**)**  **{**  GstAlsaSink **\***alsa**;**  gint err**;**  alsa **=** **GST\_ALSA\_SINK** **(**asink**);**  **GST\_ALSA\_SINK\_LOCK** **(**asink**);**  GST\_DEBUG\_OBJECT **(**alsa**,** "drop"**);**  **CHECK** **(**snd\_pcm\_drop **(**alsa**->***handle***),** drop\_error**);**  GST\_DEBUG\_OBJECT **(**alsa**,** "prepare"**);**  **CHECK** **(**snd\_pcm\_prepare **(**alsa**->***handle***),** prepare\_error**);**  GST\_DEBUG\_OBJECT **(**alsa**,** "reset done"**);**  **GST\_ALSA\_SINK\_UNLOCK** **(**asink**);**  **return;**  */\* ERRORS \*/*  drop\_error**:**  **{**  GST\_ERROR\_OBJECT **(**alsa**,** "alsa-reset: pcm drop error: %s"**,**  snd\_strerror **(**err**));**  **GST\_ALSA\_SINK\_UNLOCK** **(**asink**);**  **return;**  **}**  prepare\_error**:**  **{**  GST\_ERROR\_OBJECT **(**alsa**,** "alsa-reset: pcm prepare error: %s"**,**  snd\_strerror **(**err**));**  **GST\_ALSA\_SINK\_UNLOCK** **(**asink**);**  **return;**  **}**  **}** |

|  |
| --- |
| **static** gint  gst\_alsasink\_write **(**GstAudioSink **\*** asink**,** gpointer data**,** guint length**)**  **{**  GstAlsaSink **\***alsa**;**  gint err**;**  gint cptr**;**  guint8 **\***ptr **=** data**;**  alsa **=** **GST\_ALSA\_SINK** **(**asink**);**  **if** **(**alsa**->***iec958* **&&** alsa**->***need\_swap***)** **{**  guint i**;**  guint16 **\***ptr\_tmp **=** **(**guint16 **\*)** ptr**;**  GST\_DEBUG\_OBJECT **(**asink**,** "swapping bytes"**);**  **for** **(**i **=** 0**;** i **<** length **/** 2**;** i**++)** **{**  ptr\_tmp**[**i**]** **=** GUINT16\_SWAP\_LE\_BE **(**ptr\_tmp**[**i**]);**  **}**  **}**  GST\_LOG\_OBJECT **(**asink**,** "received audio samples buffer of %u bytes"**,** length**);**  cptr **=** length **/** alsa**->***bpf***;**  **GST\_ALSA\_SINK\_LOCK** **(**asink**);**  **while** **(**cptr **>** 0**)** **{**  */\* start by doing a blocking wait for free space. Set the timeout*  *\* to 4 times the period time \*/*  err **=** snd\_pcm\_wait **(**alsa**->***handle***,** **(**4 **\*** alsa**->***period\_time* **/** 1000**));**  **if** **(**err **<** 0**)** **{**  GST\_DEBUG\_OBJECT **(**asink**,** "wait error, %d"**,** err**);**  **}** **else** **{**  **GST\_DELAY\_SINK\_LOCK** **(**asink**);**  err **=** snd\_pcm\_writei **(**alsa**->***handle***,** ptr**,** cptr**);**  **GST\_DELAY\_SINK\_UNLOCK** **(**asink**);**  **}**  GST\_DEBUG\_OBJECT **(**asink**,** "written %d frames out of %d"**,** err**,** cptr**);**  **if** **(**err **<** 0**)** **{**  GST\_DEBUG\_OBJECT **(**asink**,** "Write error: %s"**,** snd\_strerror **(**err**));**  **if** **(**err **==** **-**EAGAIN**)** **{**  **continue;**  **}** **else** **if** **(**err **==** **-**ENODEV**)** **{**  **goto** device\_disappeared**;**  **}** **else** **if** **(**xrun\_recovery **(**alsa**,** alsa**->***handle***,** err**)** **<** 0**)** **{**  **goto** write\_error**;**  **}**  **continue;**  **}**  ptr **+=** snd\_pcm\_frames\_to\_bytes **(**alsa**->***handle***,** err**);**  cptr **-=** err**;**  **}**  **GST\_ALSA\_SINK\_UNLOCK** **(**asink**);**  **return** length **-** **(**cptr **\*** alsa**->***bpf***);**  write\_error**:**  **{**  **GST\_ALSA\_SINK\_UNLOCK** **(**asink**);**  **return** length**;** */\* skip one period \*/*  **}**  device\_disappeared**:**  **{**  GST\_ELEMENT\_ERROR **(**asink**,** RESOURCE**,** WRITE**,**  **(\_(**"Error outputting to audio device. "  "The device has been disconnected."**)),** **(**NULL**));**  **goto** write\_error**;**  **}**  **}** |

