Thinking beyond Source Code

Remember Steve Jobs

Android Audio System (1)

三月 7th, 2010 9 Comments/6787 hits

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Date: 2010-3-10

This post is talk about Android Audio system, and it's will be use audio recording as example, because I debug audio a recording bug these days, and I found there very few people talking about sound recording, I think I should do it.

This topic have 2 part: **1**. Audio Abstract Layer; 2. Hardware Layer.

Let start the part **1**:

I just assume that you can get a copy of android code, this topic use android 2.0 code. Maybe the arch will evolve in further.

* Related code:
[**1**]. droid/frameworks/bash/media/libmedia/AudioRecord*
[2]. droid/external/opencore/android/author/android_audio_input*
[3]. droid/hardware/frameworks/bash/libs/audioflinger/*

* Role:

** Control Server - AudioFlinger

(in System Server), For The Command such as create new AudioTrack,control hardware devices.

** Media Server - AudioRecord

(in Media server, for compress/decompress audio data, AudioRecord** Client Side - Application Using JNI & RPC to request media server to record/play sound.

* Communication between Role
AudioFlinger and mediaServer use shared memory (called Heap in android) to IPC, general idea was raw data in Heap, and use a semaphore to tell other data is ready or need more data.

Application and mediaServer use Binder RPC to communicate.

* Control Stream:

Application -> request recording -> Java -> jni -> mediaserver ->opencore ->opencore/android /author/android_audio_input*

** After Application RPC to media server

** MeidaServer Side: android_audio_input.cpp: audio_thread_func():

1.1 create and AudioRecord object pass AudioSource, SampleRate, Format, Channels, and buffer count, and flags, the class is defined in [**1**],

1.2 In AudioRecord.cpp:

This class then class the set member function, it will check the incoming prams, and get a AudioPolicyServericeClient from binder, compute the frame size in byte by formula:

frame Size(bytes) = channel Count * (format in byte(PCM 16 BIT is 2 bytes);

The recording buffer is set least 2 frame.

set() will call openRecord to PRC AudioFlinger->opencRecord()

** Into AudioFlinger
1.3 In AudioFlinger:

openRecord: The func will check the Premission first,and get a RecordThread in Recordthread Pool.

And create a new RecordTrack use the RecordTrack to create a RecordHandle return this Handler to caller. the cblk is a shared memory between AudioFlinger and it's user.

** Back MediaServer
1.4 Go Back to AudioRecord:

The openRecord very care about Cblk(control block of track).
back to set();

set() will new a ClientRecordThread, this thread will continue call the *this 's processAudioBuffer(), ProcessAudioBuffer first check whether the position reached marked position, when it reached, call the cblk() {the control block is very strange, can

get member and call the as function, very like the callable class in C++.

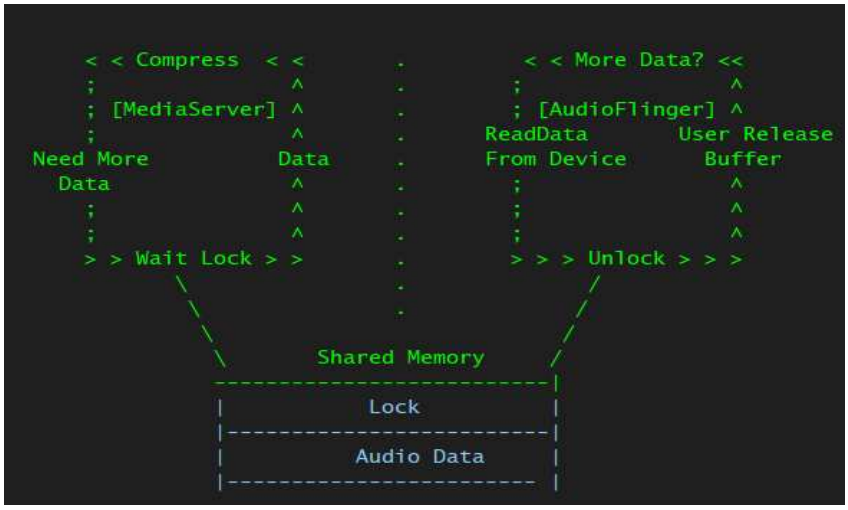
And then, it will call obtainBuffer(), this function will continue wait for the lock() of cblk, if the buffer was filled, audioFiliger will give up the lock, so here we can get the lock(), if can't get any data from device, in this function will print some log "obtainBuffer timed out (is the CPU pegged?) " message, normally when the log show up, you can't hear the voice
unless a real CPU pegged happened.

if get the buffer, the func will call the mCbf with event EVENT_MORE_DATA.

** AudioFlinger
1.5 back to AudioFlinger side:

After AudioFlinger Create a Track, it will start a Record thread, It will get into a loop, [Receive From Device] -> [Signal User] -> .. -> [Signal User]... When Receive from device, it will first lock the shared memory, read frames, and Unlock & signal users, in record mode, media server is the user.

This Figure show this process:



The archer in Figure show the sequence of state shift.

btw, you may noticed this post is have some like a org-mode , you are right, the original is written in org-mode.
android

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1. avator
   anish

2010-04-23 at 10:49 | #**1**
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"AudioFlinger and mediaServer use shared memory (called Heap in android) to IPC, general idea was raw data in Heap"

Please tell us where is this code avilable??

2. kzjeef
2010-04-26 at 10:58 | #2
Reply | Quote

> **anish :**
> "AudioFlinger and mediaServer use shared memory (called Heap in android) to IPC, general idea was raw data in Heap"
>
> Please tell us where is this code avilable??

frameworks/base/media/libmedia/AudioRecord.cpp
The audioBuffer is the shared memory, AudioTrack::obtainBuffer is wait buffer filled by audioFlinger(eg. Audio Hardware device).

3. Ray
2010-05-25 at 09:58 | #3
Reply | Quote
"if can't get any data from device, in this function will print some log "obtainBuffer timed out (is the CPU pegged?) " message, normally when the log show up, you can't hear the voice
unless a real CPU pegged happened."

unfortunately, I've met this issue when recording.
1.start recording(APP:SoundRecord)
2.stop (sound will save to a file)
then,the log kept printing "obtainBuffer timed out (is the CPU pegged?)"and also the Warning "W/AudioFlinger(1761): write blocked for 7467 msecs, **1** delayed writes, thread 0x4b3f0",you'll hear no voice in about half a minute.However,the record file played well normally...
I've no idea about this.
Could you give me some help??
Thanks a lot

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2010-05-25 at 09:58 | #4
Reply | Quote
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5. 
william
2010-05-25 at 10:01 | #5
Reply | Quote
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6. 
william
2010-05-25 at 10:02 | #6
Reply | Quote
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8. 
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2010-05-25 at 10:09 | #8
Reply | Quote
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9. 
Skiller
2010-06-04 at 21:25 | #9
Reply | Quote
"Application -> request recording -> Java -> jni -> mediaserver ->opencore ->opencore/android /author/android_audio_input*

** After Application RPC to media server

** MeidaServer Side: android_audio_input.cpp: audio_thread_func()"

Hi anish,
i am a new comer,
i'd like to know how does it go into the func:audio_thread_func()?
i tried to go back the trace from the function:
AndroidAudioInput::start_audin_thread_func <--- AndroidAudioInput::DoStart() <--- AndroidAudioInput::Start <--- ???

and what's the caller then,or how to connect the two parts"opencore ->opencore/android/author /android_audio_input*"?

thanks.

Name (required)

Mail (will not be published) (required)
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=7+3 (required)

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