

Visualized audio tracing

—— on debugging & optimizing audio I/O

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October 15, 2011

- **Mobile audio requirements**
- **Playback**
 - ALSA/PA models
 - hw ptr issues
 - reducing PA wakeups
- **Capture**
 - PA model
 - reducing latency

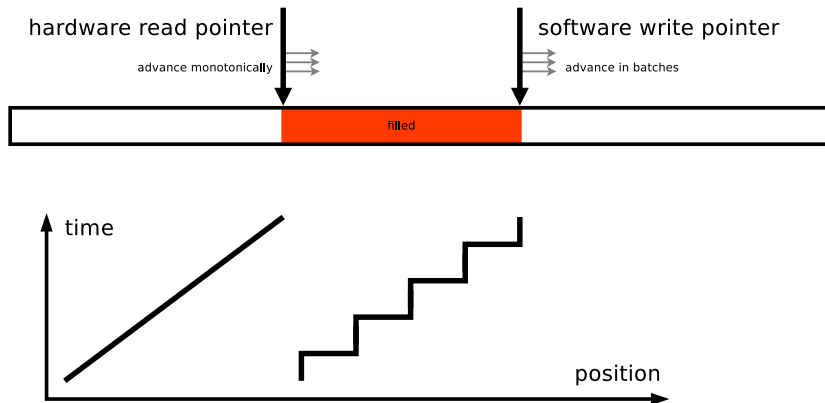
Typical mobile audio stack



Mobile audio requirements

- ❶ No drop outs (underrun/overflow)
- ❷ VOIP: 150ms mouth-to-ear delay
- ❸ Music: 1 CPU wake-up per second

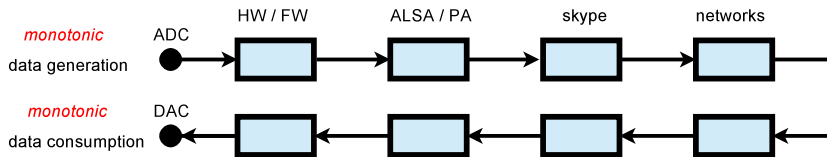
Requirement 1: no drop outs



Requirement 2: VOIP delays

Human perceivable delays

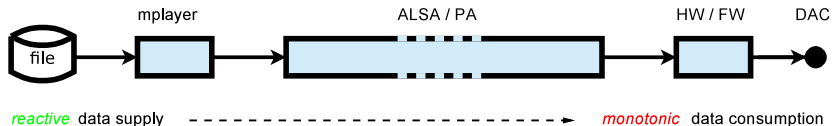
$$latency = \sum buf_time$$



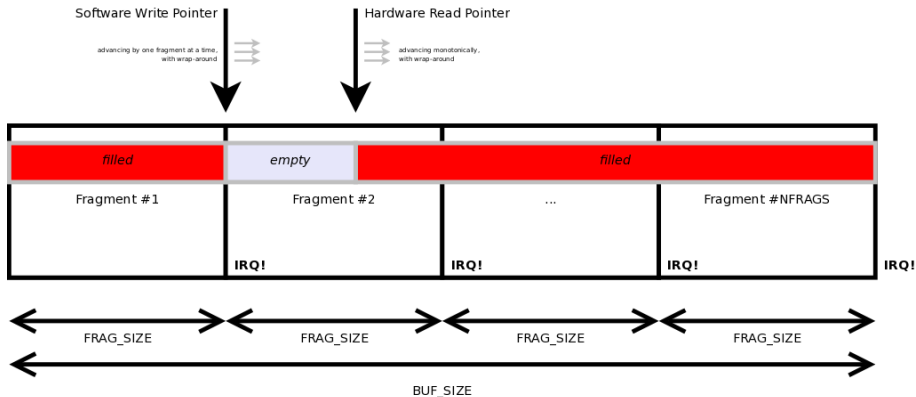
Requirement 3: minimal wakeups

Audio-Video lip sync

$$latency = \sum buf_time$$



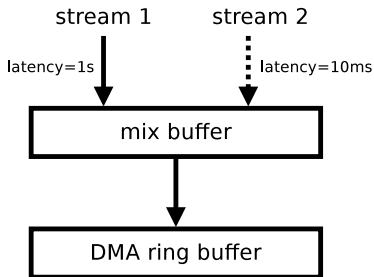
ALSA playback model: static period based



<http://0pointer.de/blog/projects/pulse-glitch-free.html>

ALSA model pros/cons

- ✓ simple and stable
- ✗ not dynamically reconfigurable for new streams



pulseaudio playback model: dynamic timer based

|<----- buffer_size ----->|

|<----- requested_latency ----->|

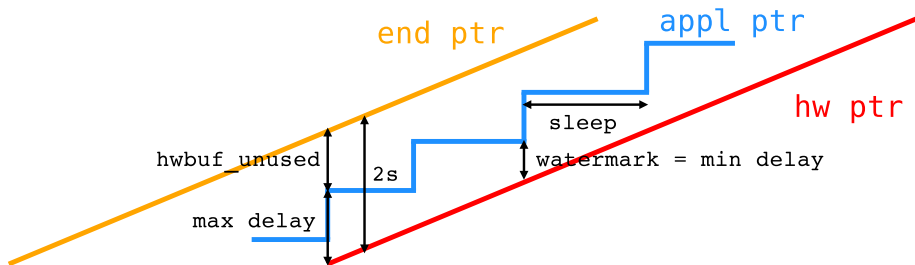
[=====]

|<-- watermark -->|<----- sleep ----->|<----- hwbuf_unused ----->|

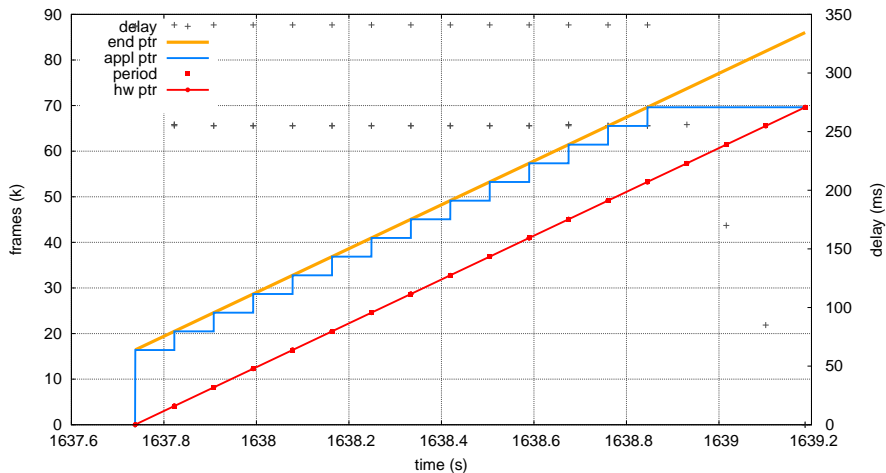
min data fill
|=====>|

max data fill
|=====>|

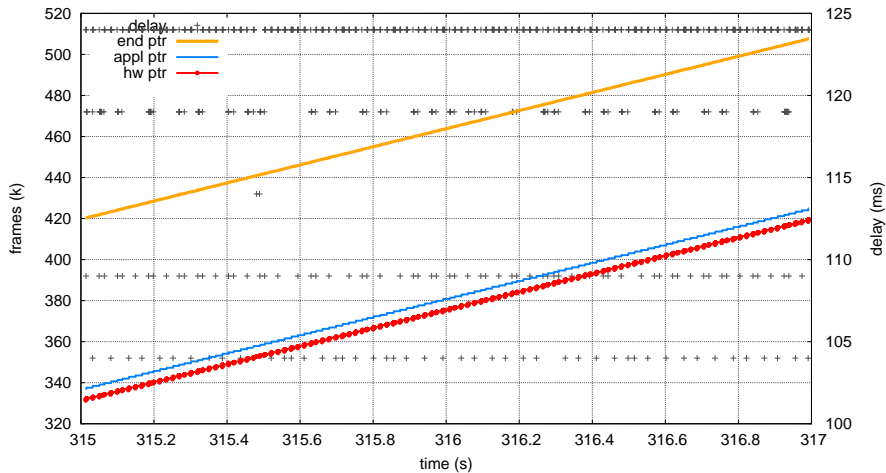
pulseaudio playback 2D view



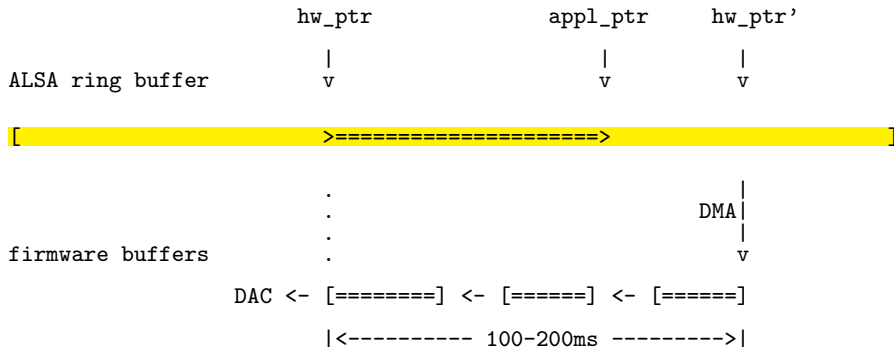
ALSA playback graph



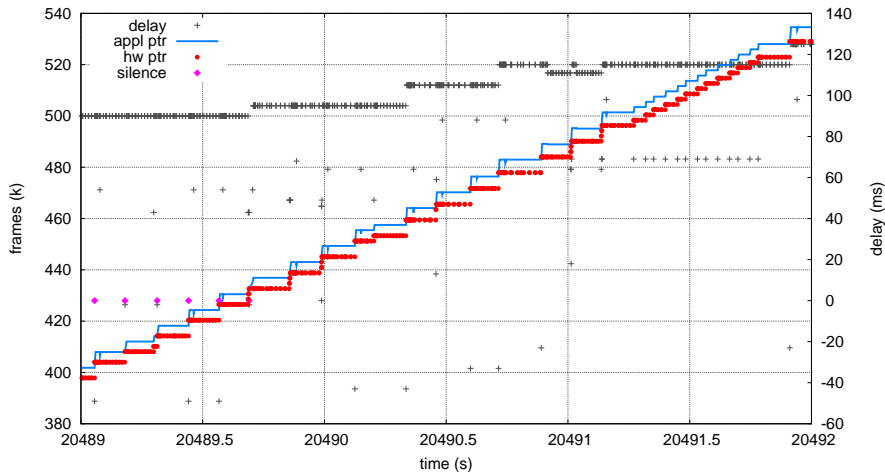
pulseaudio playback graph



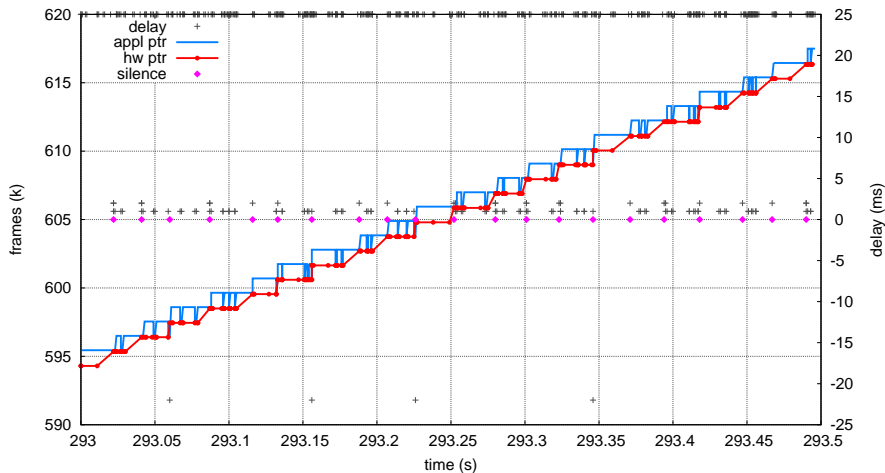
Inaccurate hw ptr \Rightarrow 2s playback delay



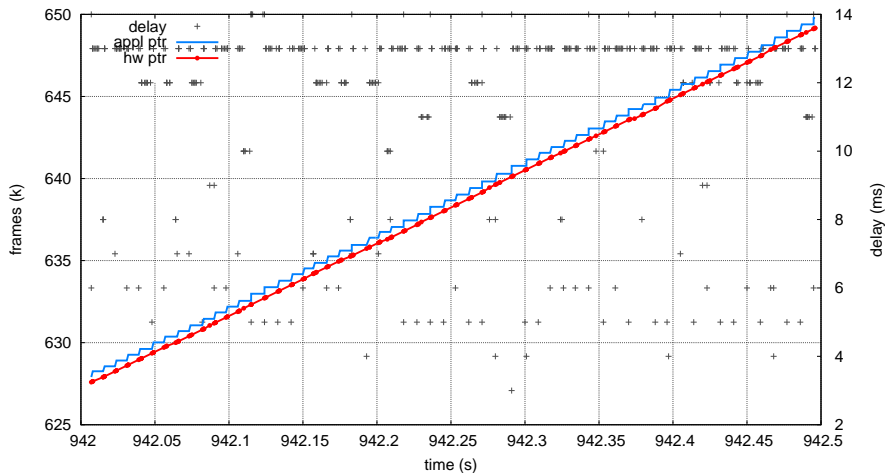
Bumping hw ptr \Rightarrow underruns



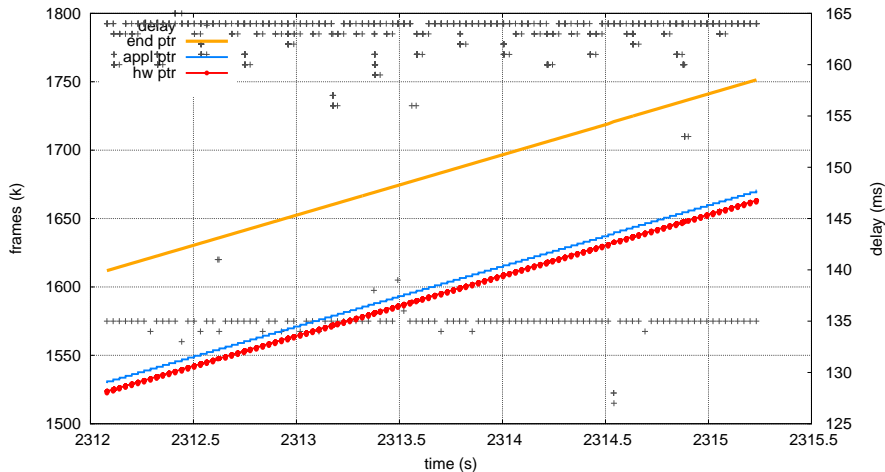
Less bumping hw ptr



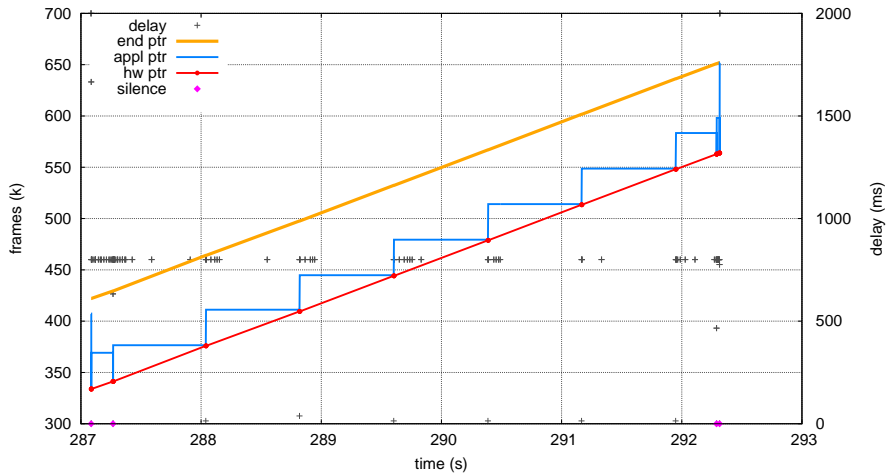
Smooth hw ptr



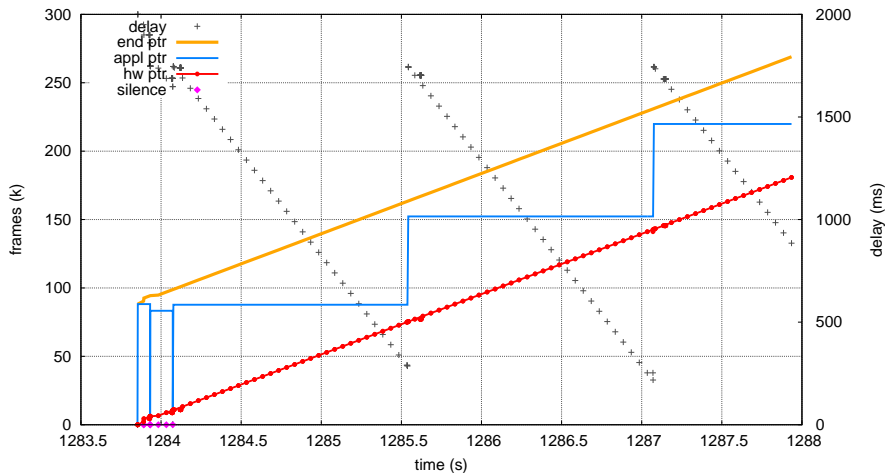
Suboptimal video playback



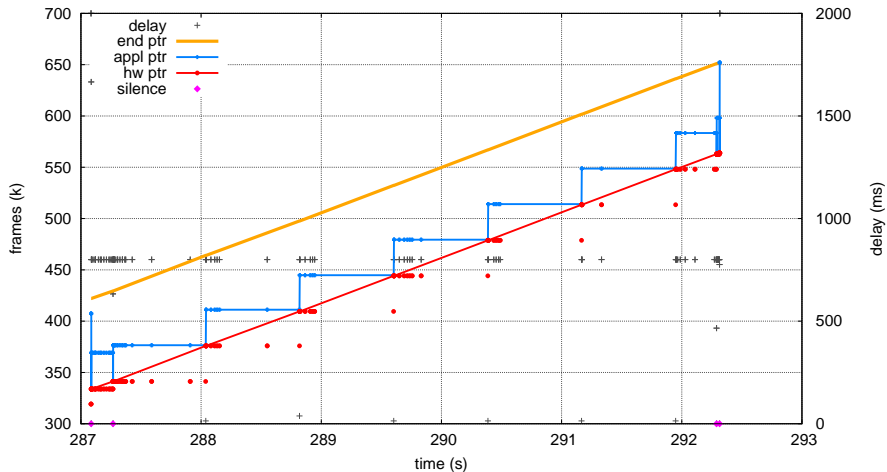
Increase latency request



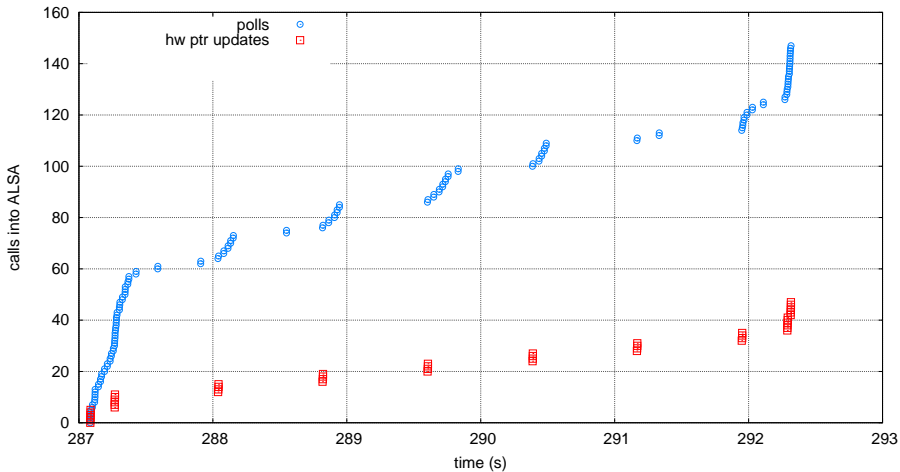
Increase safety gap



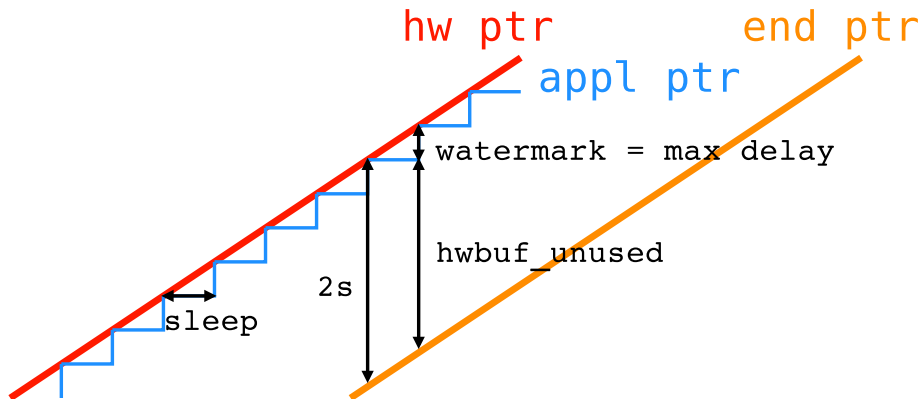
Extra pulseaudio wakeups



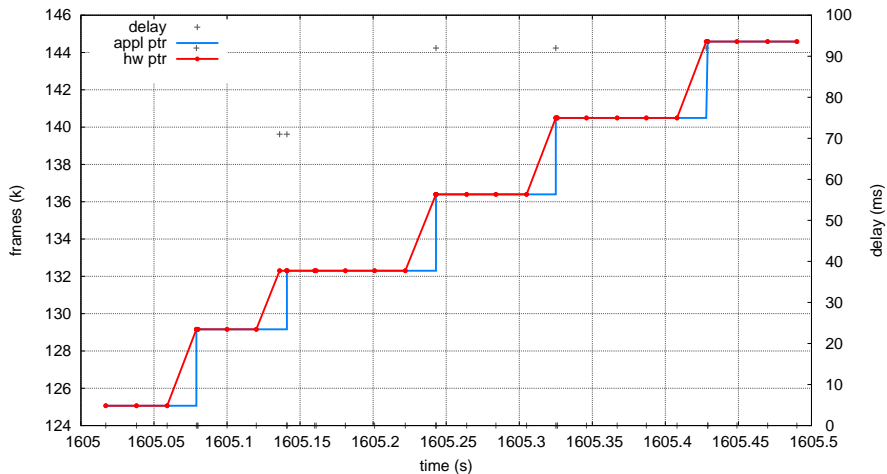
Extra pulseaudio wakeups (events count)



pulseaudio capture model

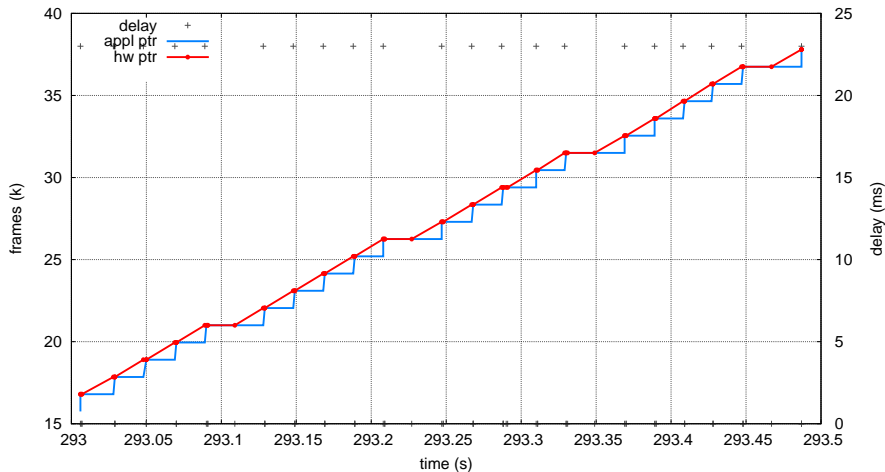


Capture latency: 100ms

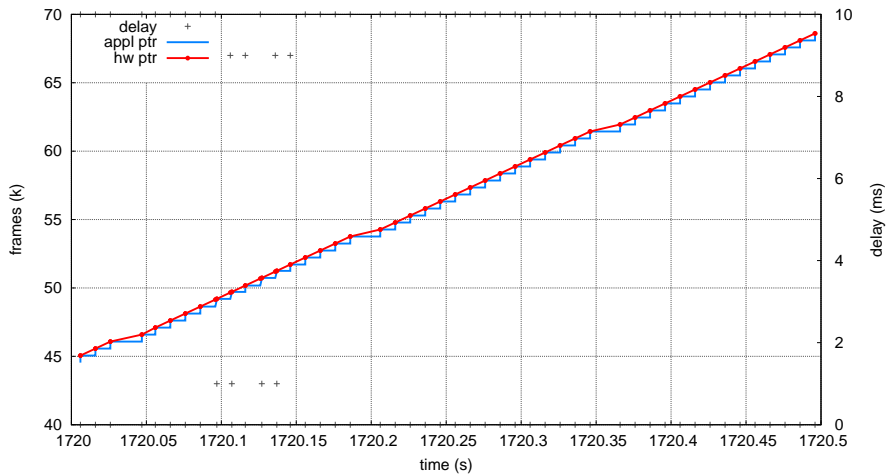


```
gst-launch-0.10 pulsesrc latency-time=10000 ! pulsesink buffer-time=50000 latency-time=10000
```


Capture latency: 23ms



Capture latency: 10ms



Acknowledgements

- Tang Feng
- Lu Guanqun
- Wang Xingchao
- Lin Mengdong
- Michael Fu

Thank you!



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