

What's next for Bluetooth in PulseAudio?

Sanchayan Maity

asymptotic.io

What is PulseAudio?

- ▶ Initial release on 17 July 2004

What is PulseAudio?

- ▶ Initial release on 17 July 2004
- ▶ First appeared for users in Fedora Linux with version 8

What is PulseAudio?

- ▶ Initial release on 17 July 2004
- ▶ First appeared for users in Fedora Linux with version 8
- ▶ Mediates access to audio resources on your system

What is PulseAudio?

- ▶ Initial release on 17 July 2004
- ▶ First appeared for users in Fedora Linux with version 8
- ▶ Mediates access to audio resources on your system
- ▶ Features?

What is PulseAudio?

- ▶ Initial release on 17 July 2004
- ▶ First appeared for users in Fedora Linux with version 8
- ▶ Mediates access to audio resources on your system
- ▶ Features?
 - ▶ Audio mixing

What is PulseAudio?

- ▶ Initial release on 17 July 2004
- ▶ First appeared for users in Fedora Linux with version 8
- ▶ Mediates access to audio resources on your system
- ▶ Features?
 - ▶ Audio mixing
 - ▶ Per application volume controls

What is PulseAudio?

- ▶ Initial release on 17 July 2004
- ▶ First appeared for users in Fedora Linux with version 8
- ▶ Mediates access to audio resources on your system
- ▶ Features?
 - ▶ Audio mixing
 - ▶ Per application volume controls
 - ▶ Multiple sources and sinks

What is PulseAudio?

- ▶ Initial release on 17 July 2004
- ▶ First appeared for users in Fedora Linux with version 8
- ▶ Mediates access to audio resources on your system
- ▶ Features?
 - ▶ Audio mixing
 - ▶ Per application volume controls
 - ▶ Multiple sources and sinks
 - ▶ Combine multiple sound cards and synchronize multiple playback streams

What is PulseAudio?

- ▶ Initial release on 17 July 2004
- ▶ First appeared for users in Fedora Linux with version 8
- ▶ Mediates access to audio resources on your system
- ▶ Features?
 - ▶ Audio mixing
 - ▶ Per application volume controls
 - ▶ Multiple sources and sinks
 - ▶ Combine multiple sound cards and synchronize multiple playback streams
 - ▶ Bluetooth support

What is PulseAudio?

- ▶ Initial release on 17 July 2004
- ▶ First appeared for users in Fedora Linux with version 8
- ▶ Mediates access to audio resources on your system
- ▶ Features?
 - ▶ Audio mixing
 - ▶ Per application volume controls
 - ▶ Multiple sources and sinks
 - ▶ Combine multiple sound cards and synchronize multiple playback streams
 - ▶ Bluetooth support
 - ▶ Command line interface with scripting capabilities

- ▶ Initial release on 17 July 2004
- ▶ First appeared for users in Fedora Linux with version 8
- ▶ Mediates access to audio resources on your system
- ▶ Features?
 - ▶ Audio mixing
 - ▶ Per application volume controls
 - ▶ Multiple sources and sinks
 - ▶ Combine multiple sound cards and synchronize multiple playback streams
 - ▶ Bluetooth support
 - ▶ Command line interface with scripting capabilities
 - ▶ Sound daemon with reconfiguration capabilities

- ▶ What is a profile?

- ▶ What is a profile?
- ▶ Some of the widely used bluetooth profiles

- ▶ What is a profile?
- ▶ Some of the widely used bluetooth profiles
 - ▶ Advanced Audio Distribution Profile (A2DP)

- ▶ What is a profile?
- ▶ Some of the widely used bluetooth profiles
 - ▶ Advanced Audio Distribution Profile (A2DP)
 - ▶ Audio/Video Remote Control Profile (AVRCP)

- ▶ What is a profile?
- ▶ Some of the widely used bluetooth profiles
 - ▶ Advanced Audio Distribution Profile (A2DP)
 - ▶ Audio/Video Remote Control Profile (AVRCP)
 - ▶ Headset Profile (HSP)

- ▶ What is a profile?
- ▶ Some of the widely used bluetooth profiles
 - ▶ Advanced Audio Distribution Profile (A2DP)
 - ▶ Audio/Video Remote Control Profile (AVRCP)
 - ▶ Headset Profile (HSP)
 - ▶ Hands-Free Profile (HFP)

- ▶ Available codecs?

- ▶ Available codecs?
 - ▶ Low-complexity subband codec (SBC)

- ▶ Available codecs?
 - ▶ Low-complexity subband codec (SBC)
 - ▶ Audio Processing Technology (aptX, aptX-HD)

- ▶ Available codecs?
 - ▶ Low-complexity subband codec (SBC)
 - ▶ Audio Processing Technology (aptX, aptX-HD)
 - ▶ Advanced Audio Coding (AAC)

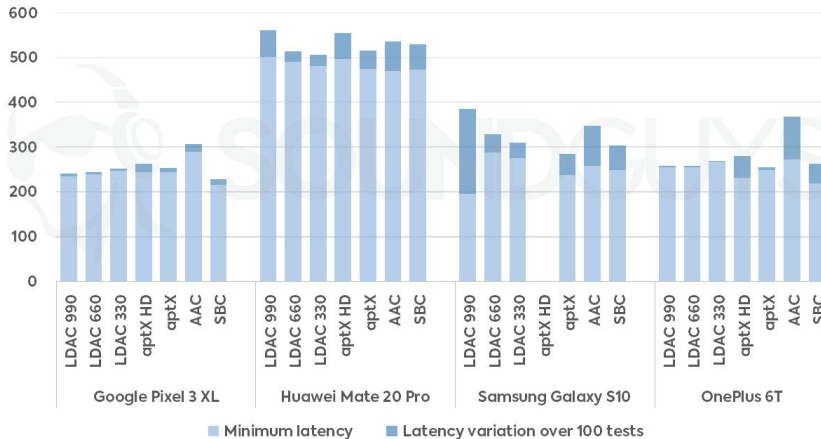
- ▶ Available codecs?
 - ▶ Low-complexity subband codec (SBC)
 - ▶ Audio Processing Technology (aptX, aptX-HD)
 - ▶ Advanced Audio Coding (AAC)
 - ▶ LDAC

So which is better?

HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)



Bluetooth Codec Latency by Smartphone (milliseconds)



- ▶ Upstream only supports SBC :(

- ▶ Upstream only supports SBC :(
- ▶ HSP/HFP support

- ▶ Upstream only supports SBC :(
- ▶ HSP/HFP support
- ▶ Out of tree community effort with pulseaudio-modules-bt

- ▶ Upstream only supports SBC :(
- ▶ HSP/HFP support
- ▶ Out of tree community effort with pulseaudio-modules-bt
- ▶ Messaging API

- ▶ Codec switching

- ▶ Codec switching
- ▶ Patent encumbered licenses?

- ▶ Codec switching
- ▶ Patent encumbered licenses?
- ▶ How to support multiple encoders or decoders?

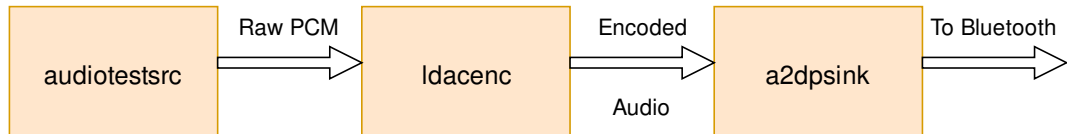
- ▶ Codec switching
- ▶ Patent encumbered licenses?
- ▶ How to support multiple encoders or decoders?
- ▶ Contributors? Maintainers?

- ▶ What is GStreamer?

- ▶ What is GStreamer?
- ▶ Why?

Example Pipeline

```
gst-launch-1.0 -v audiotestsrc !  
audio/x-raw,rate=44100,channels=2,format=S32LE !  
ldacenc eqmid=2 ! a2dpsink  
transport=/org/bluez/hci0/dev_4C_BC_98_80_01_9B/sep10/fd0
```



- ▶ LDAC support upstreamed in GStreamer

- ▶ LDAC support upstreamed in GStreamer
- ▶ Support for Low-Overhead MPEG-4 Audio Transport Multiplex (LATM) AAC in GStreamer

- ▶ LDAC support upstreamed in GStreamer
- ▶ Support for Low-Overhead MPEG-4 Audio Transport Multiplex (LATM) AAC in GStreamer
- ▶ GStreamer wrapper around *libopenaptx*. Work done by Igor Kovalenko.

- ▶ LDAC support upstreamed in GStreamer
- ▶ Support for Low-Overhead MPEG-4 Audio Transport Multiplex (LATM) AAC in GStreamer
- ▶ GStreamer wrapper around *libopenaptx*. Work done by Igor Kovalenko.
- ▶ Implementing codec switching

- ▶ LDAC support upstreamed in GStreamer
- ▶ Support for Low-Overhead MPEG-4 Audio Transport Multiplex (LATM) AAC in GStreamer
- ▶ GStreamer wrapper around *libopenaptx*. Work done by Igor Kovalenko.
- ▶ Implementing codec switching
- ▶ Proof of concept with GStreamer tested

- ▶ LDAC support upstreamed in GStreamer
- ▶ Support for Low-Overhead MPEG-4 Audio Transport Multiplex (LATM) AAC in GStreamer
- ▶ GStreamer wrapper around *libopenaptx*. Work done by Igor Kovalenko.
- ▶ Implementing codec switching
- ▶ Proof of concept with GStreamer tested
- ▶ Merge request opened in PulseAudio

Questions?

► So what's next?

- ▶ So what's next?
 - ▶ Support Adaptive Bit Rate (ABR) in LDAC

- ▶ So what's next?
 - ▶ Support Adaptive Bit Rate (ABR) in LDAC
 - ▶ mSBC support for HFP profile

- ▶ So what's next?
 - ▶ Support Adaptive Bit Rate (ABR) in LDAC
 - ▶ mSBC support for HFP profile
 - ▶ LC3 codec

- ▶ So what's next?
 - ▶ Support Adaptive Bit Rate (ABR) in LDAC
 - ▶ mSBC support for HFP profile
 - ▶ LC3 codec
 - ▶ Allowing users to specify the preference order for codecs

- ▶ So what's next?
 - ▶ Support Adaptive Bit Rate (ABR) in LDAC
 - ▶ mSBC support for HFP profile
 - ▶ LC3 codec
 - ▶ Allowing users to specify the preference order for codecs
 - ▶ Support Opus as a vendor codec for PulseAudio <-> PulseAudio