

## What's next for Bluetooth in PulseAudio?

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# 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
  - ▶ Sound daemon with reconfiguration capabilities

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

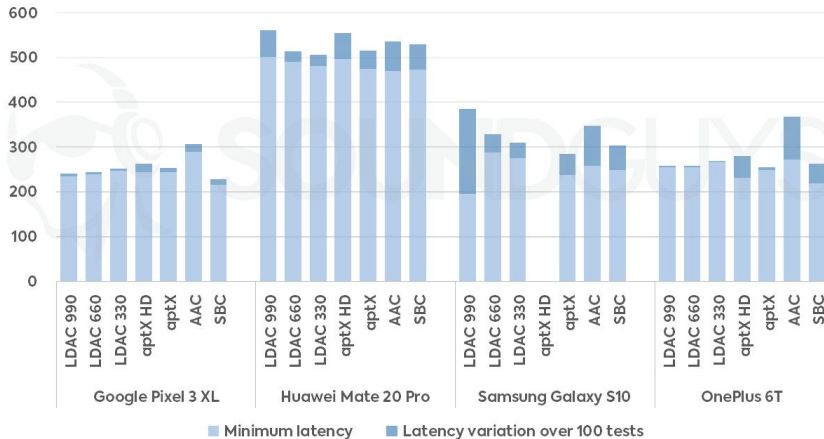
So which is better?

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



## Bluetooth Codec Latency by Smartphone (milliseconds)



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

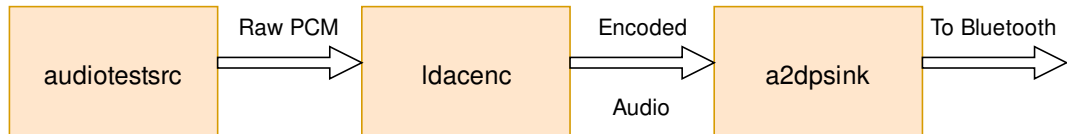
- ▶ Codec switching
- ▶ Patent encumbered licenses?
- ▶ How to support multiple encoders or decoders?
- ▶ Contributors? Maintainers?



- ▶ 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
- ▶ 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

- ▶ 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