Pipewire

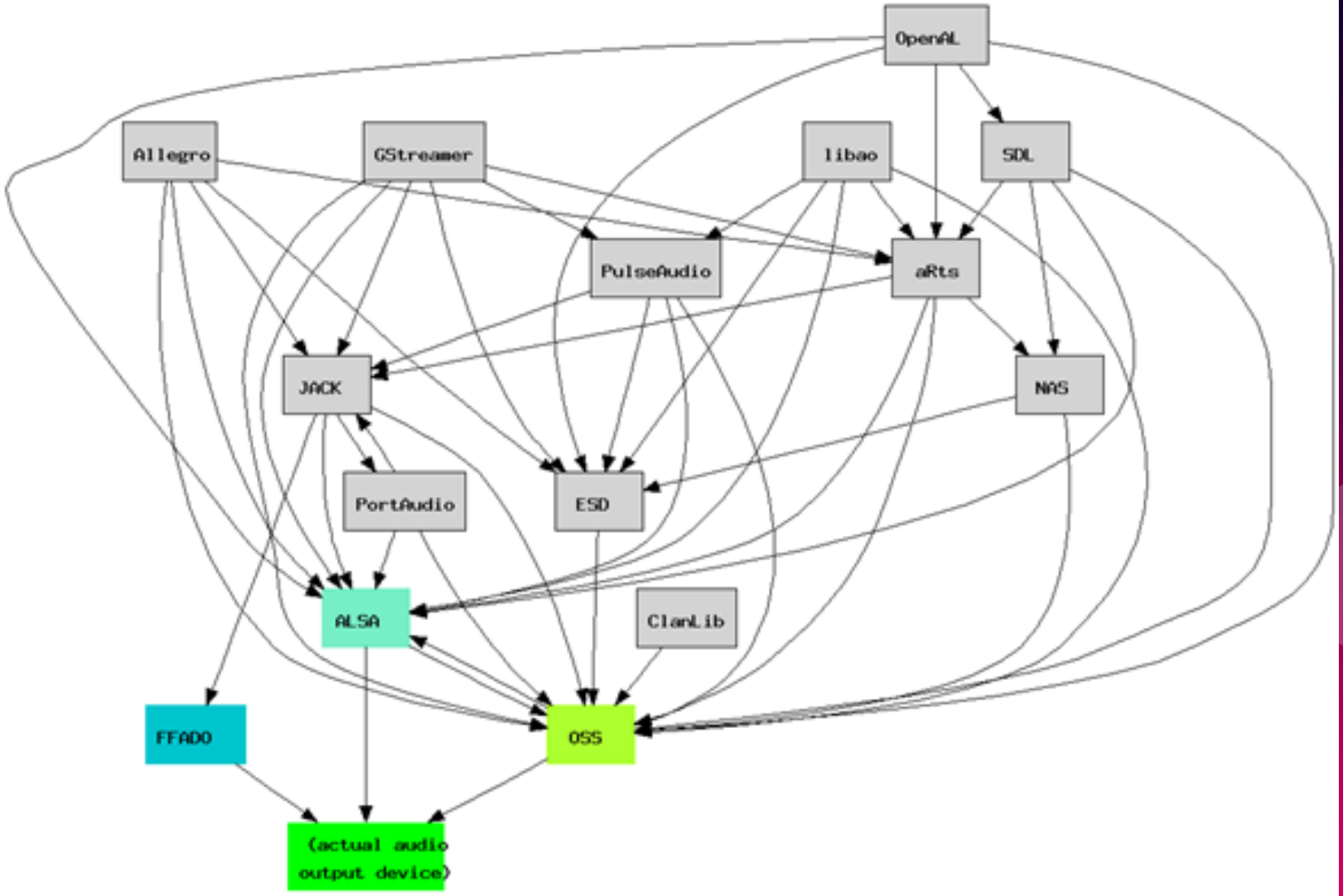
Next-generation cross-desktop audio and video server

Introduction

- /dev/dsp – Open Sound System
  - One application can use at a time (on Linux at least)
    - Still used and advanced by FreeBSD
  - Sound servers e.g. aRts, Esound.
- ALSA – Advanced Linux Sound Architecture
  - In-kernel since 2.5
  - Capable of software mixing and resampling
    - OSS emulation mode, can use multiple apps at once
  - Remains the userspace interface to hardware

Current sound servers

- PulseAudio (desktop, 2004)
  - Accepts sound input from one or more *sources*
  - Redirects to *sinks*, can include network transport
  - Can emulate prior interfaces including ALSA userland
  - Supports realtime via RTKit, but runs at a defined higher latency
- JACK (professional, 2002)
  - Low latency, realtime, but can’t negotiate formats/security
- Possible, but difficult, to layer these on top of each other



Jungle Of Linux Audio Output Methods
http://blogs.adobe.com/penguin.swf/
Updated May 12, 2007

Video

- Gstreamer
  - GNOME aligned video routing and rendering
  - Was largely designed/written by Wim Taymans 2004-15
- V4L2
  - Used for webcam captures etc

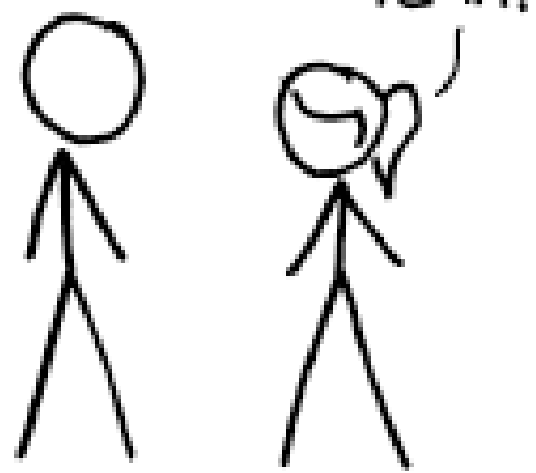
Problems

- Too many frameworks
- Multiple daemons
  - Choose between low latency or compatibility
- Lack of client isolation and permissions
  - Apps in containers can listen to other apps or microphones
  - How to share screen video under Wayland? More secure than X11
- Could one server handle all of this?

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

SITUATION:
THERE ARE
14 COMPETING
STANDARDS.

14?! RIDICULOUS!
WE NEED TO DEVELOP
ONE UNIVERSAL STANDARD
THAT COVERS EVERYONE'S
USE CASES.



SOON:

SITUATION:
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15 COMPETING
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Pipewire

- Started by Wim Taymans in 2015
  - Initially named “Pinos” and inspired by “PulseVideo” idea
  - To improve video streams like PulseAudio improved audio
- Decided to incorporate audio in 2017
  - Much of the same logic, keeps stream synchronisation
- Required by GNOME’s Mutter for the last few releases
  - Video screen sharing under Wayland
- Shipped in Fedora 34 as default sound server

Pipewire design

- Unifies PulseAudio, JACK and ALSA
  - Can emulate all their interfaces, plus its own
- Permissions
  - Doesn’t rely on “video” and “audio” groups
  - Supports containers like Flatpak
- Low latency and low CPU use
  - Buffers as small as 16 samples
  - “Pull” model, request more audio when buffer (quantum) low

Architecture

- SPA, “Simple Plugin API”
  - C based
  - Nodes with multiple enumerable ports
  - Extensible format description
  - Buffers passed by ID, zero allocation at runtime
  - Asynchronous and synchronous processing
- Nodes can be dynamically created, destroyed and routed
- Multiprocess, realtime support

Session Manager

- Set up nodes
- Handles permissions
- Can do advanced routing and logic
  - Depending on what devices are available

- Old: pipewire-media-session
- New: wireplumber

Performance

- https://gitlab.freedesktop.org/pipewire/pipewire/-/wikis/Performance
- Latency (with tuning) at 32 samples to USB:
  - Pipewire: 5.9ms
  - JACK2: 4.7ms

44.1khz/16bit	Context Switch (server/client)	CPU (server/client)
Pipewire	862/445	0.005/0.004
PulseAudio	9739/2949	0.214/0.040

Also solved?

- Bluetooth
  - Supports newer codecs like LDAC
  - Automatic switching to/from headset profile
- Audio effects
  - Native support for channel mixing, parametric equaliser, convolver
  - Inbuilt support for LADSPA plugins
  - “Easyeffects” (formerly Pulseeffects) can do a lot of DSP
- Sample rates and audio passthrough
  - Can switch on the fly depending on app requests

Future

- Replacing PulseAudio and JACK
- Integrating with GStreamer and V4L2 (may partly replace)
- Support from automotive industry
- Finally audio on par or better than other OSs

- Now, let’s play with it...