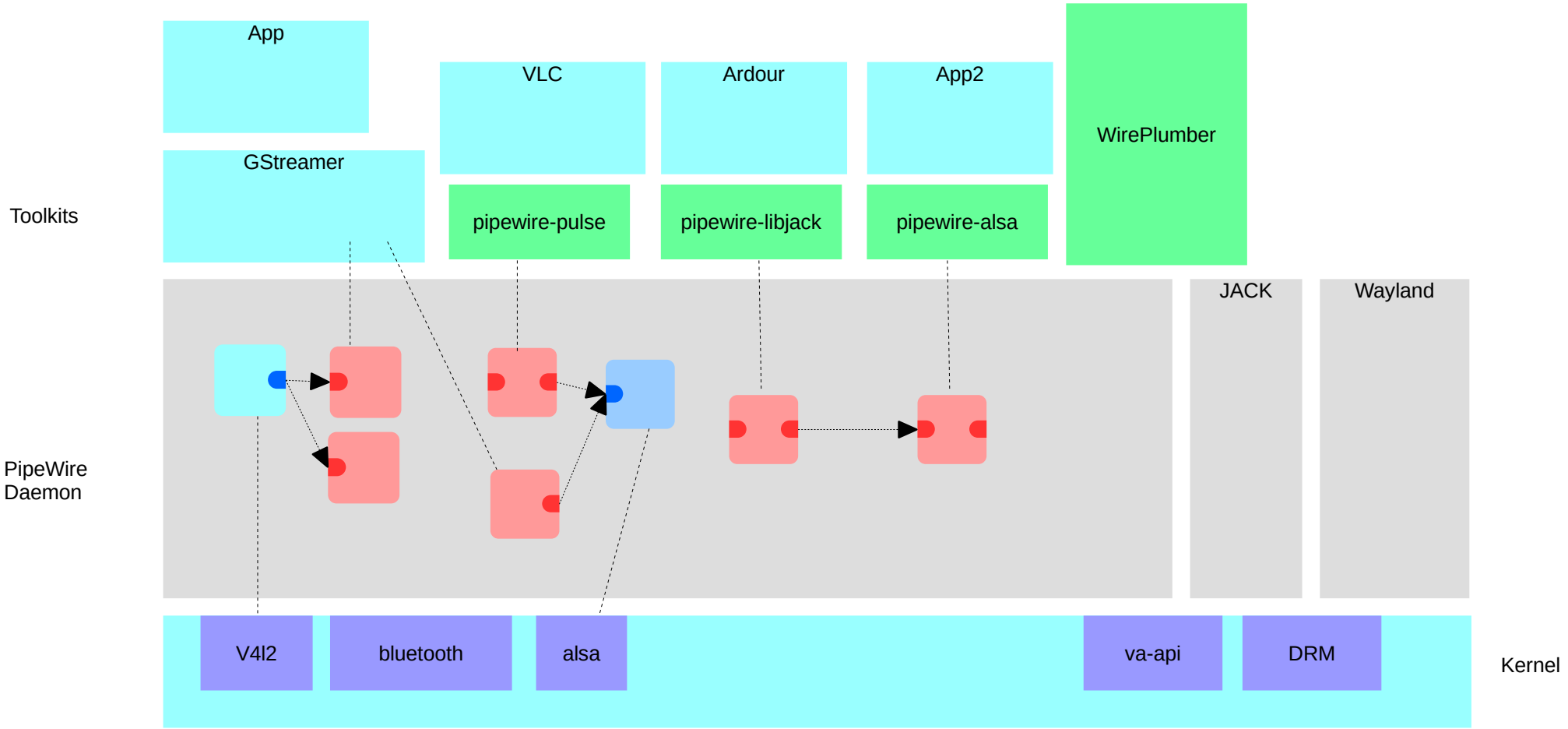
PipeWire

Wim Taymans
Principal Software Engineer
FOSDEM 2023

What is PipeWire

Multimedia sharing and processing engine

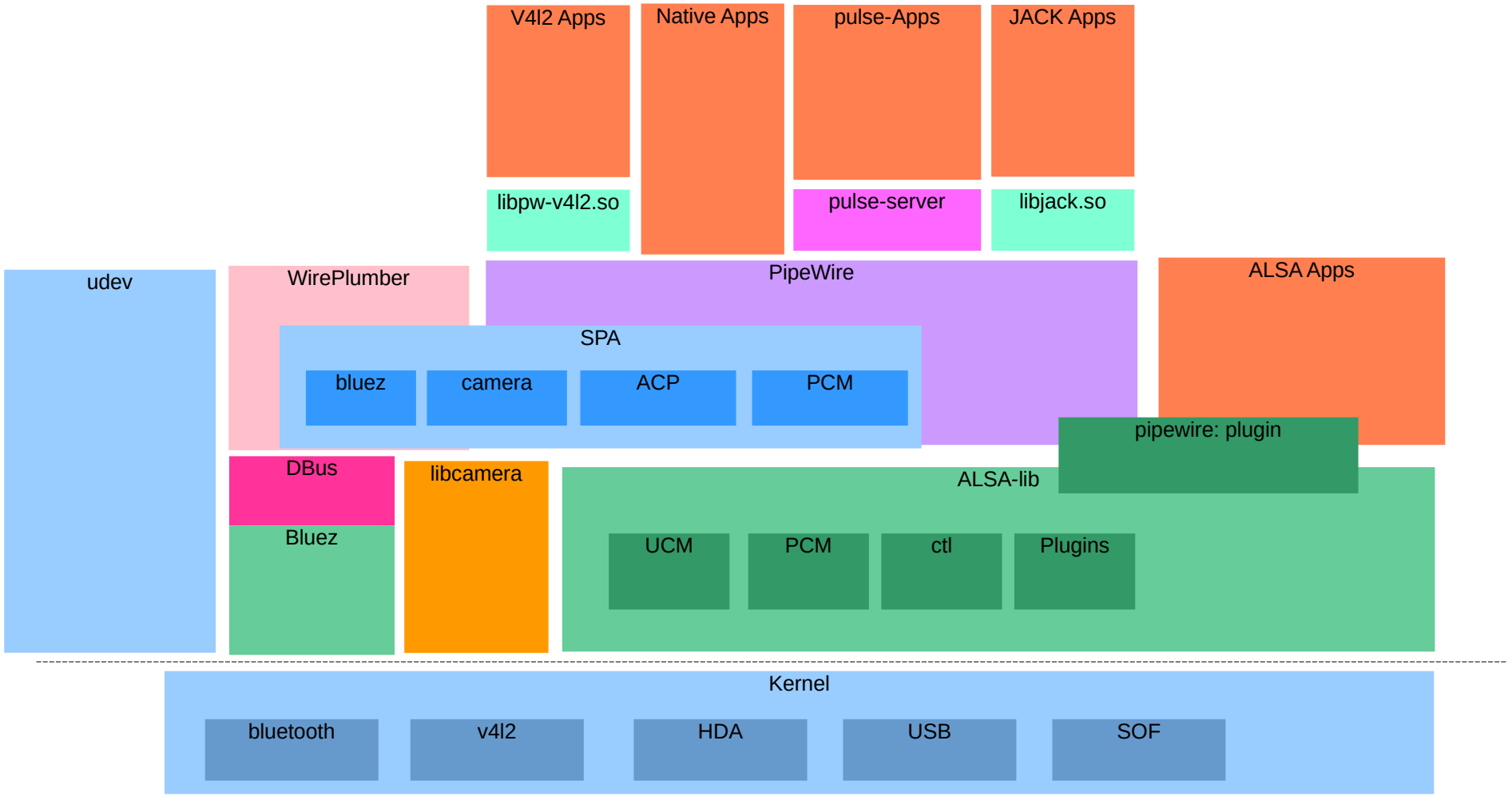
PipeWire


App
VLC
Ardour
App2
WirePlumber
GStreamer
Toolkits
pipewire-pulse
pipewire-libjack
pipewire-alsa
JACK
Wayland
PipeWire
Daemon
V4l2
bluetooth
alsa
va-api
DRM
Kernel

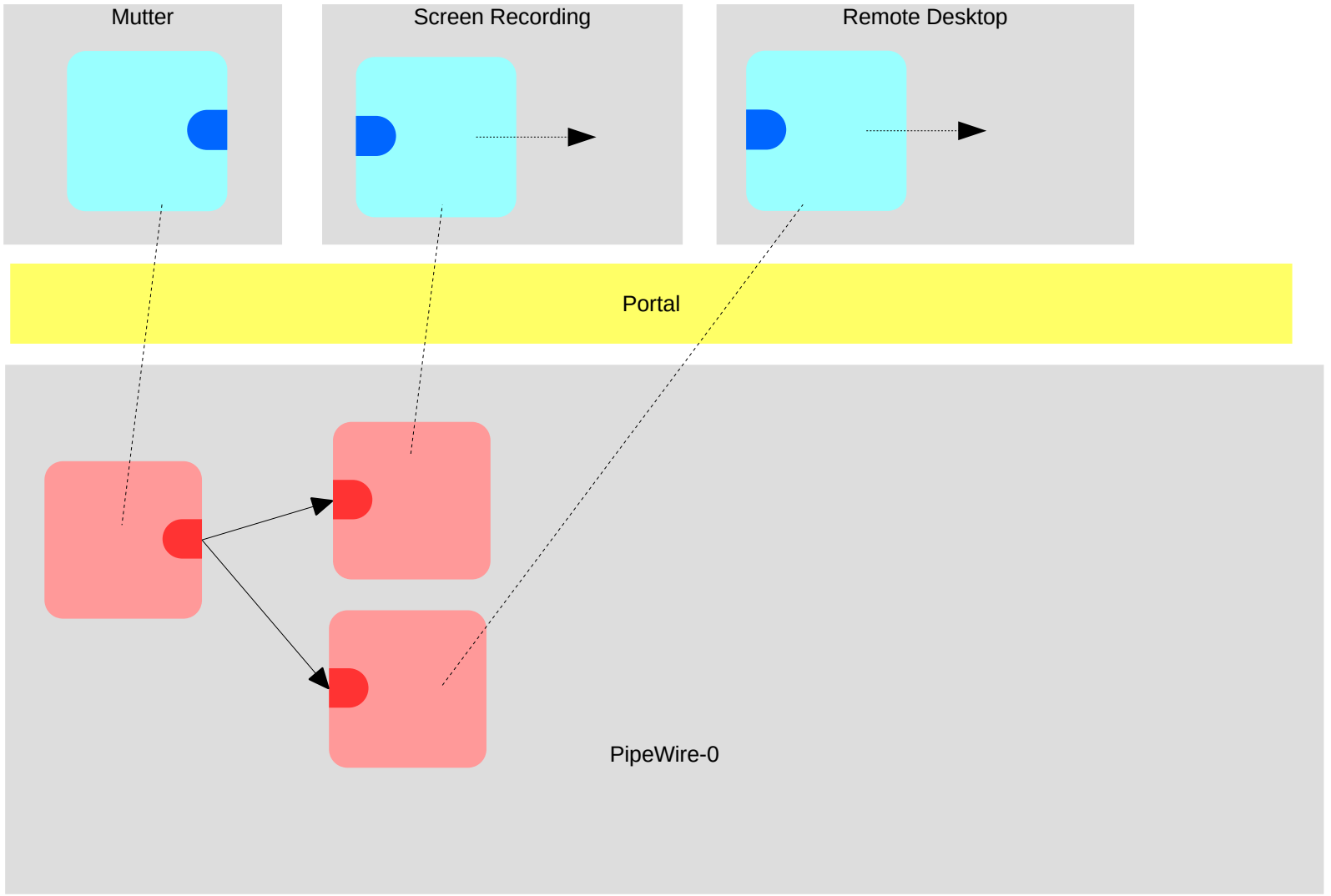
Features

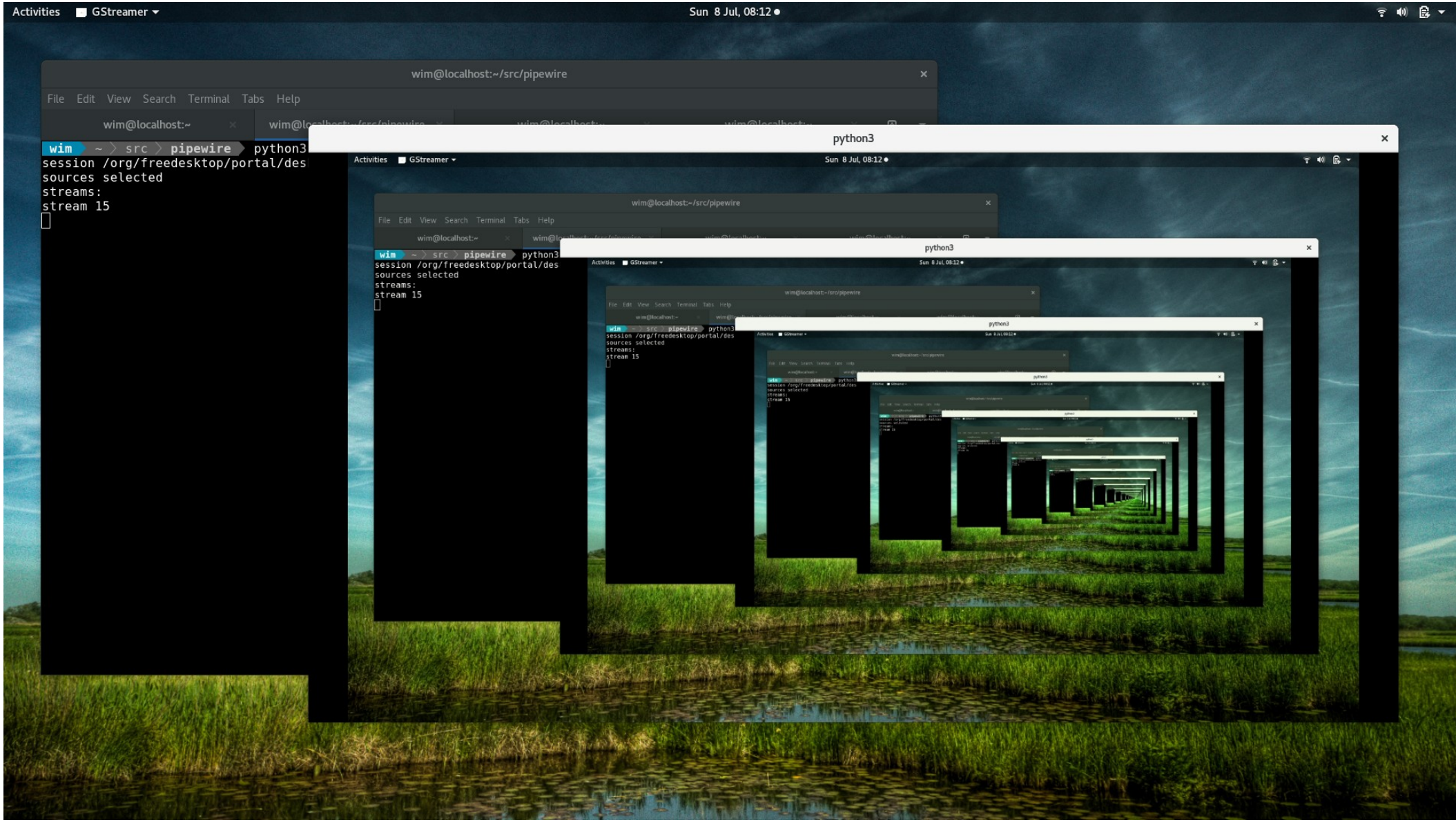
- Exchange media with devices and other apps
  - Zero copy, shared memory, memfd, dmabuf, eventfd
- Security per application
  - Visible objects (R), methods (WX), metadata (M)..
- RT capable, low latency (<1.5ms), JACK-like scheduler reduced context switches. Similar performance.
- All media types + generic control streams
- Extensible: types, protocol, ...
- External session manager implements policy

Overview


V4l2 Apps
Native Apps
pulse-Apps
JACK Apps
libpw-v4l2.so
pulse-server
libjack.so
udev
WirePlumber
PipeWire
ALSA Apps
SPA
bluez
camera
ACP
PCM
pipewire: plugin
DBus
libcamera
ALSA-lib
Bluez
UCM
PCM
ctl
Plugins
Kernel
bluetooth
v4l2
HDA
USB
SOF

Wayland screen sharing



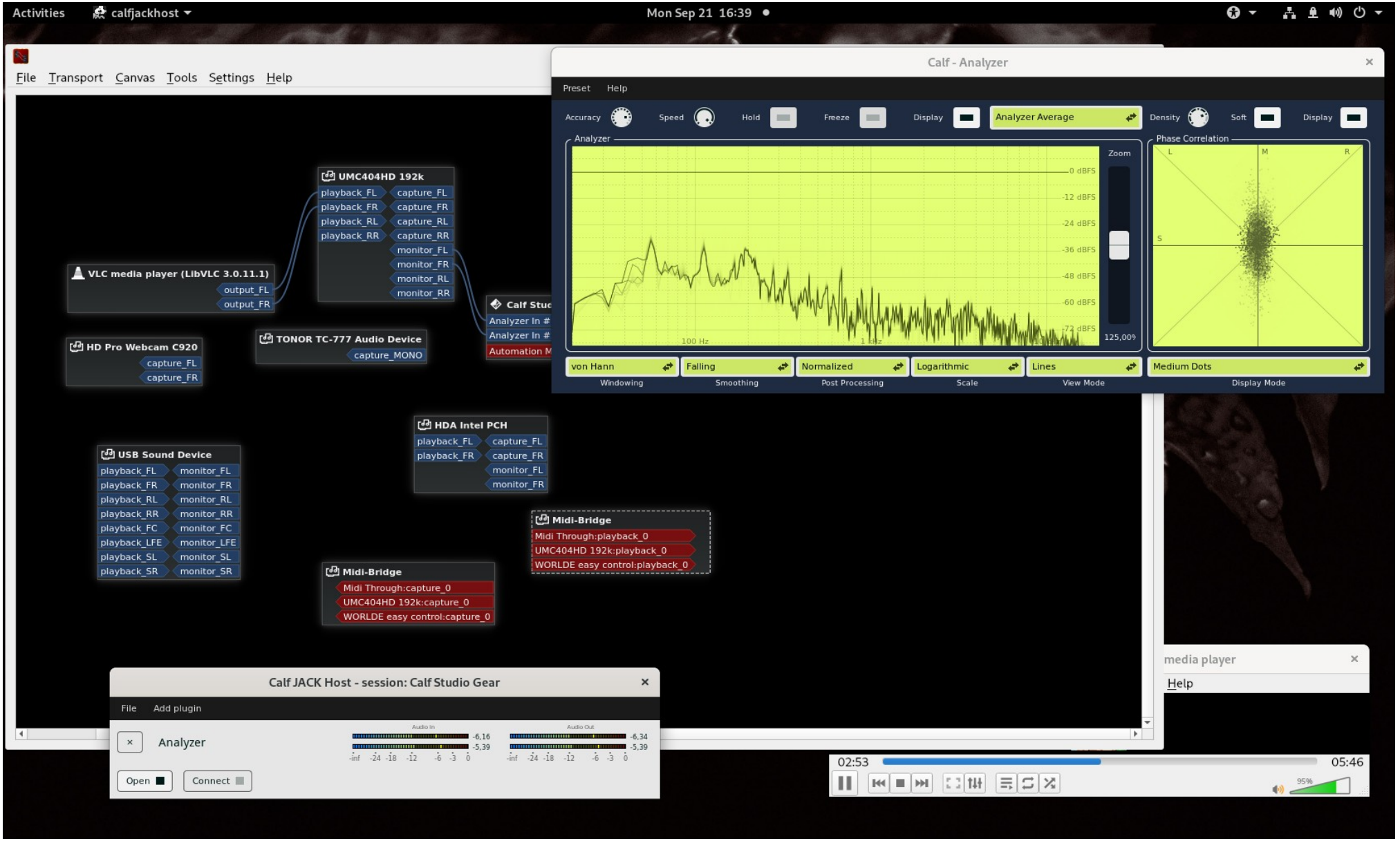

Activities
GStreamer
Sun 8 Jul, 08:12
wim@localhost:~/src/pipewire
File Edit View Search Terminal Tabs Help
wim@localhost:~
wim ~ src pipewire python3
session /org/freedesktop/portal/des
sources selected
streams:
stream 15
python3

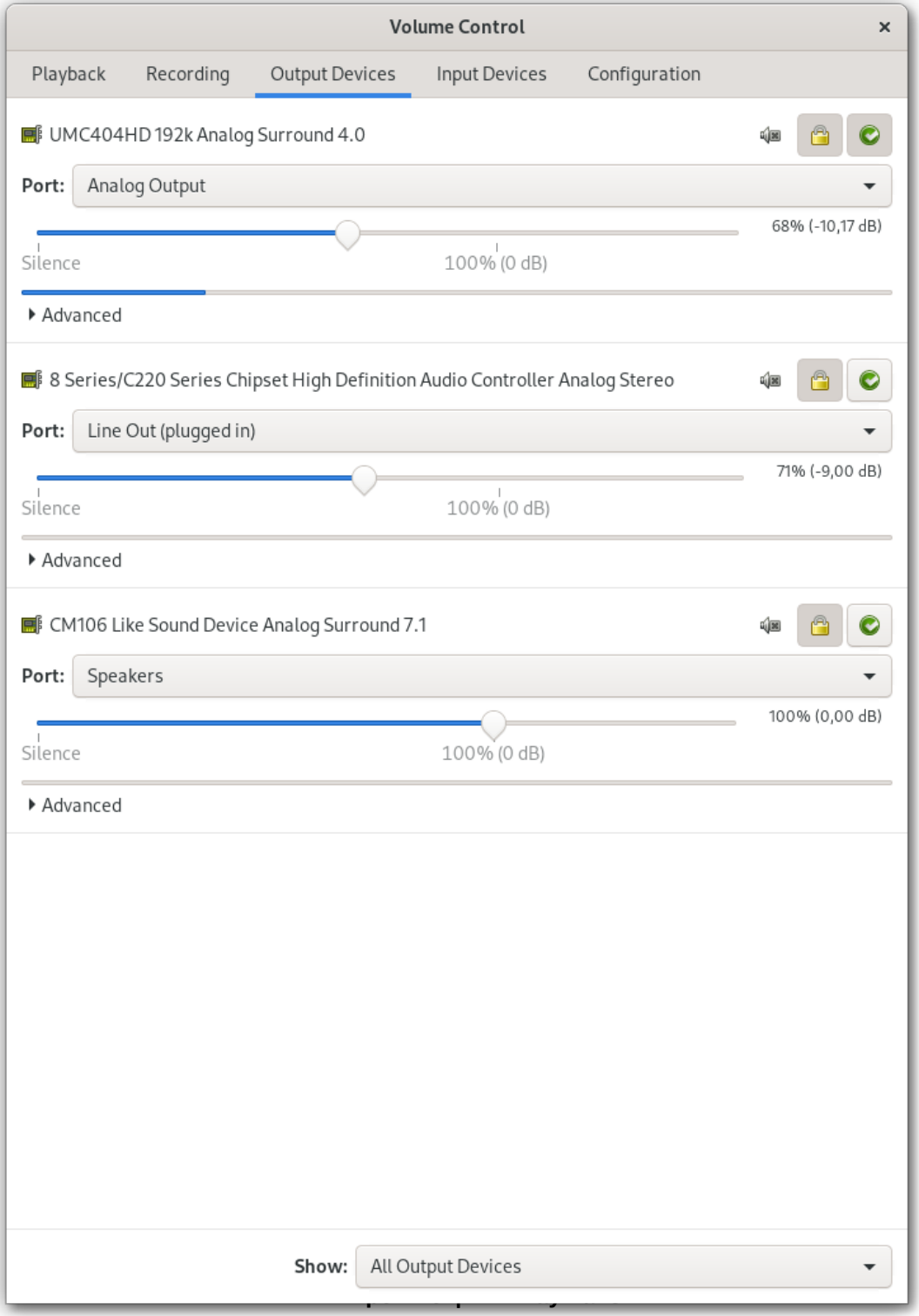
Audio Support

- Pro Audio model like JACK is chosen
  - 1 format (float32) Channels are split into mono streams
  - 1 buffer size (but is dynamic in PipeWire)
  - Sinks/Sources are wrapped with an audio adapter in front to mix, merge, resample, split and convert the channels
  - Multiple devices, Automatic clock slaving when joined, like zita-ajbridge
  - Midi in generic control stream. Exposes ports and devices like a2jmidid

Audio Support (PipeWire specific)

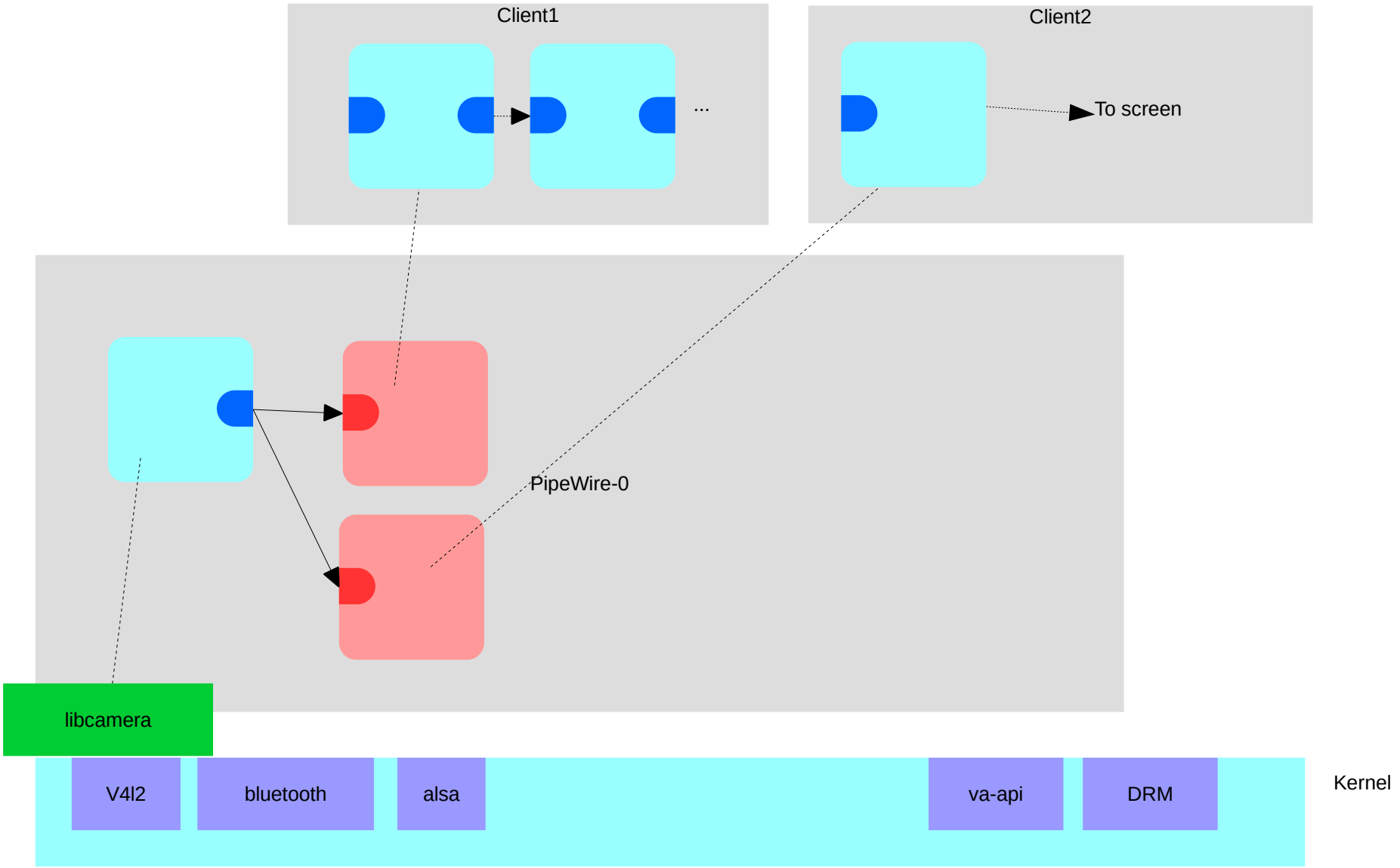
- Uses timer based scheduling
  - Like PulseAudio (but using a much more accurate timing model)
  - IRQ based scheduling also possible but not yet implemented
  - Can dynamically change buffer size (and thus latency)
- Uses ACP (copy of PulseAudio card profiles), UCM devices, profiles, ports, soft/hw volumes, jack detection, It supports ALSA API and UCM profiles.
- Highly optimized audio processing paths.
- A hybrid between JACK and PulseAudio.

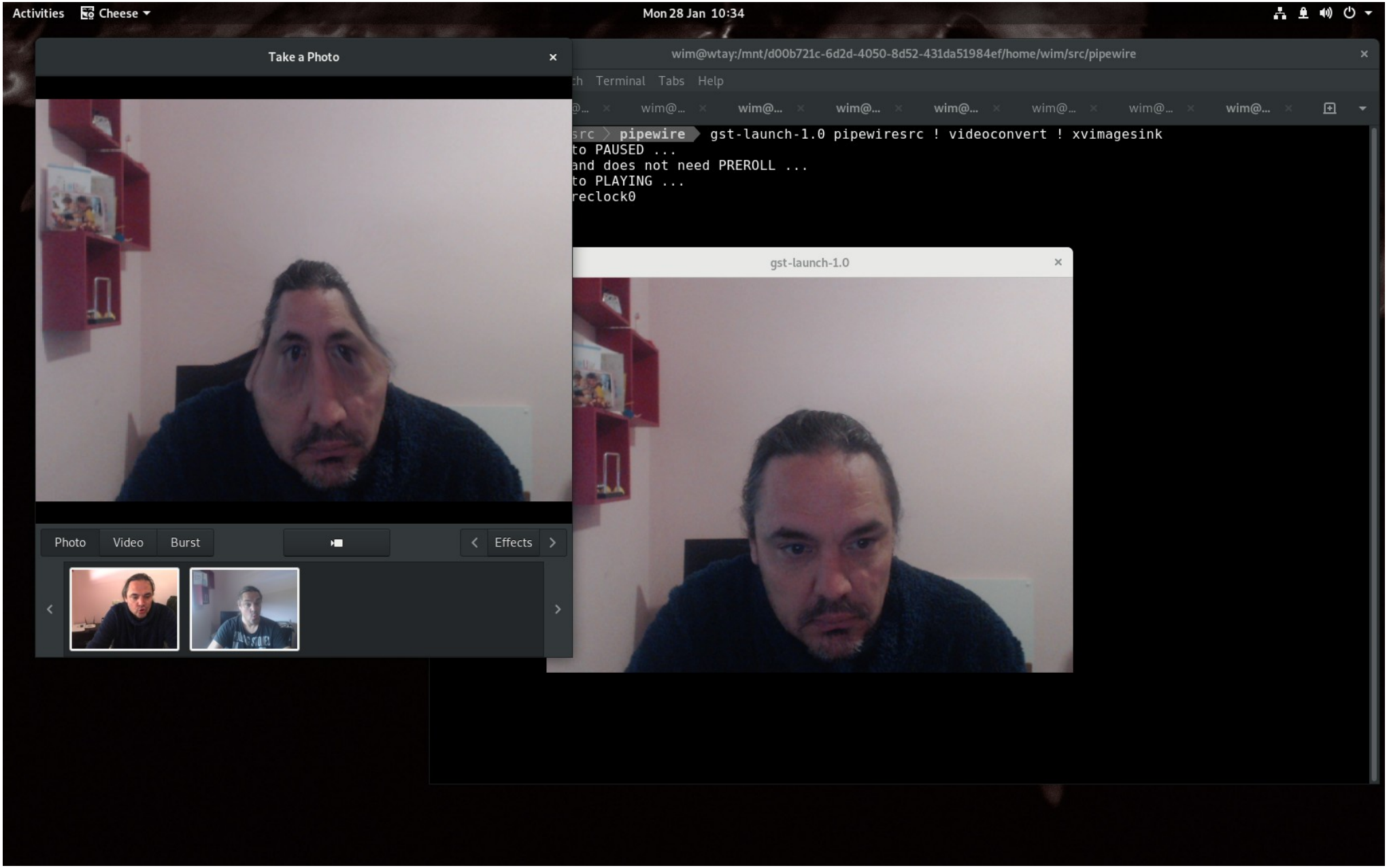

Activities
calfjackhost
Mon Sep 21 16:39
File Transport Canvas Tools Settings Help
Calf - Analyzer
Preset Help
Accuracy Speed Hold Freeze Display Analyzer Average Density Soft Display
Analyzer
Zoom
0 dBFS
-12 dBFS
-24 dBFS
-36 dBFS
-48 dBFS
-60 dBFS
-72 dBFS
100 Hz
1 kHz
125,00%
Phase Correlation
L M R S
von Hann Falling Normalized Logarithmic Lines Medium Dots
Windowing Smoothing Post Processing Scale View Mode Display Mode
UMC404HD 192k
playback_FL playback_FR playback_RL playback_RR
capture_FL capture_FR capture_RL capture_RR
monitor_FL monitor_FR monitor_RL monitor_RR
VLC media player (LibVLC 3.0.11.1)
output_FL output_FR
Calf Stud
Analyzer In #
Analyzer In #
Automation M
HD Pro Webcam C920
capture_FL capture_FR
TONOR TC-777 Audio Device
capture_MONO
HDA Intel PCH
playback_FL playback_FR
capture_FL capture_FR
monitor_FL monitor_FR
USB Sound Device
playback_FL playback_FR playback_RL playback_RR playback_FC playback_LFE playback_SL playback_SR
monitor_FL monitor_FR monitor_RL monitor_RR monitor_FC monitor_LFE monitor_SL monitor_SR
Midi-Bridge
Midi Through:playback_0
UMC404HD 192k:playback_0
WORLDE easy control:playback_0
Midi-Bridge
Midi Through:capture_0
UMC404HD 192k:capture_0
WORLDE easy control:capture_0
Calf JACK Host - session: Calf Studio Gear
File Add plugin
Analyzer
Audio In
Audio Out
-6,16
-5,39
-6,34
-5,39
Open
Connect
media player
Help
02:53
05:46
95%


Volume Control
Playback
Recording
Output Devices
Input Devices
Configuration
UMC404HD 192k Analog Surround 4.0
Port:
Analog Output
68% (-10,17 dB)
Silence
100% (0 dB)
Advanced
8 Series/C220 Series Chipset High Definition Audio Controller Analog Stereo
Port:
Line Out (plugged in)
71% (-9,00 dB)
Silence
100% (0 dB)
Advanced
CM106 Like Sound Device Analog Surround 7.1
Port:
Speakers
100% (0,00 dB)
Silence
100% (0 dB)
Advanced
Show:
All Output Devices

Red Hat

Camera capture/sharing




Activities
Cheese
Mon 28 Jan 10:34
Take a Photo
Photo
Video
Burst
Effects
wim@wtay:/mnt/d00b721c-6d2d-4050-8d52-431da51984ef/home/wim/src/pipewire
Terminal
Tabs
Help
pipewire
gst-launch-1.0 pipewiresrc ! videoconvert ! xvimagesink
to PAUSED ...
and does not need PREROLL ...
to PLAYING ...
reclock0
gst-launch-1.0

Status

- API/ABI stable since Fedora 32 (February 2020)
- Default in Fedora 34 (February 2021)
  - https://fedoraproject.org/wiki/Changes/DefaultPipeWire
- Mostly feature parity for JACK and PulseAudio
  - Except for netjack1/2 (but alternatives exist)
  - Except for pulse DBus/DLNA modules
- Other distros already have or are switching from PulseAudio

Current focus

- Bugfixing
- Work more on Video side of things (Video routing, vulkan processing filters, ...)
- Fix up the camera elements
- WirePlumber/Portal Camera improvements
- OBS studio as a testcase
  - Camera/Screen capture with PipeWire
- Firefox/Chrome PipeWire/Portal camera support via patches to WebRTC.

http://pipewire.org
https://gitlab.freedesktop.org/pipewire/pipewire
Questions?