Integrating the driver experience
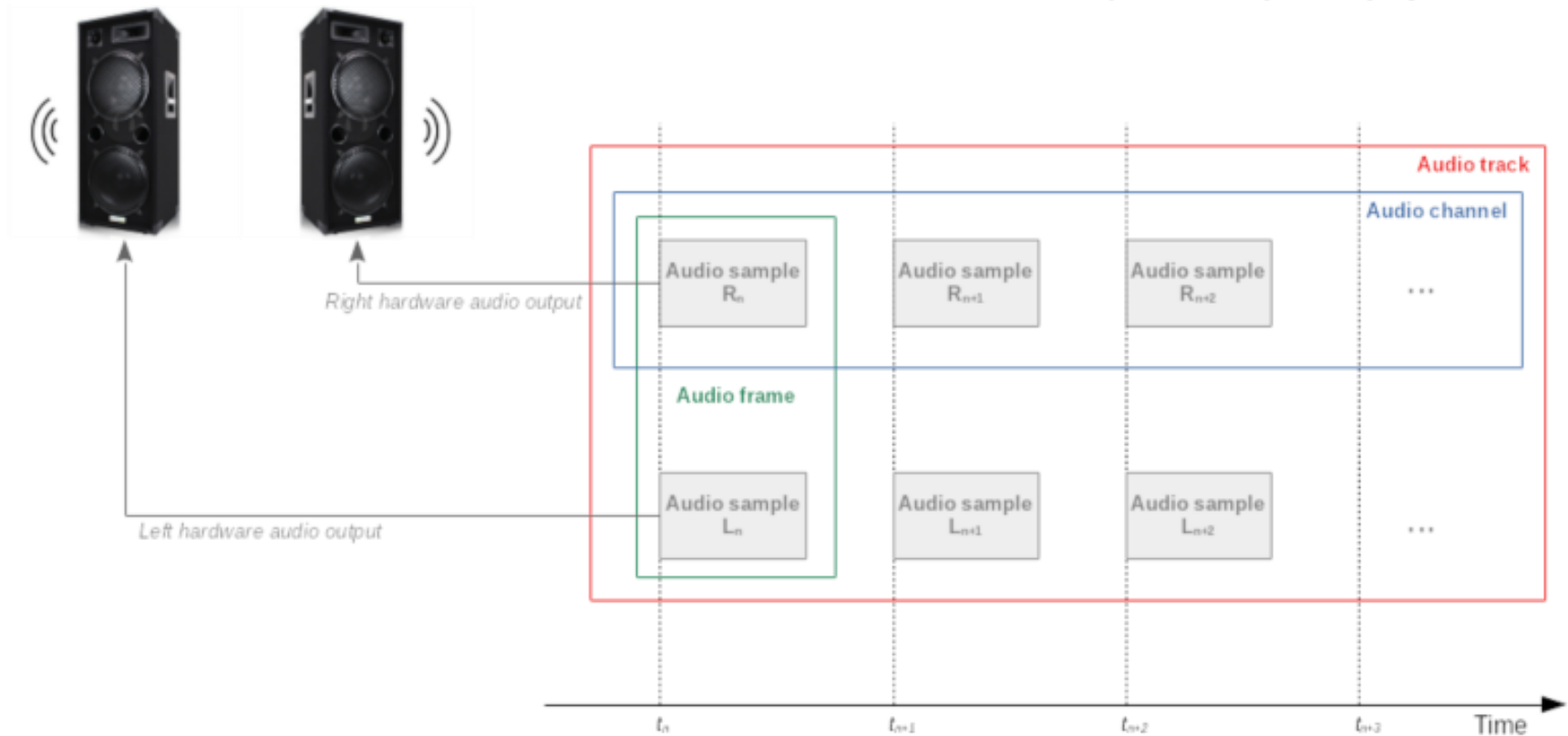
VIRTIO audio
Genivi AMM Munich 2019

public
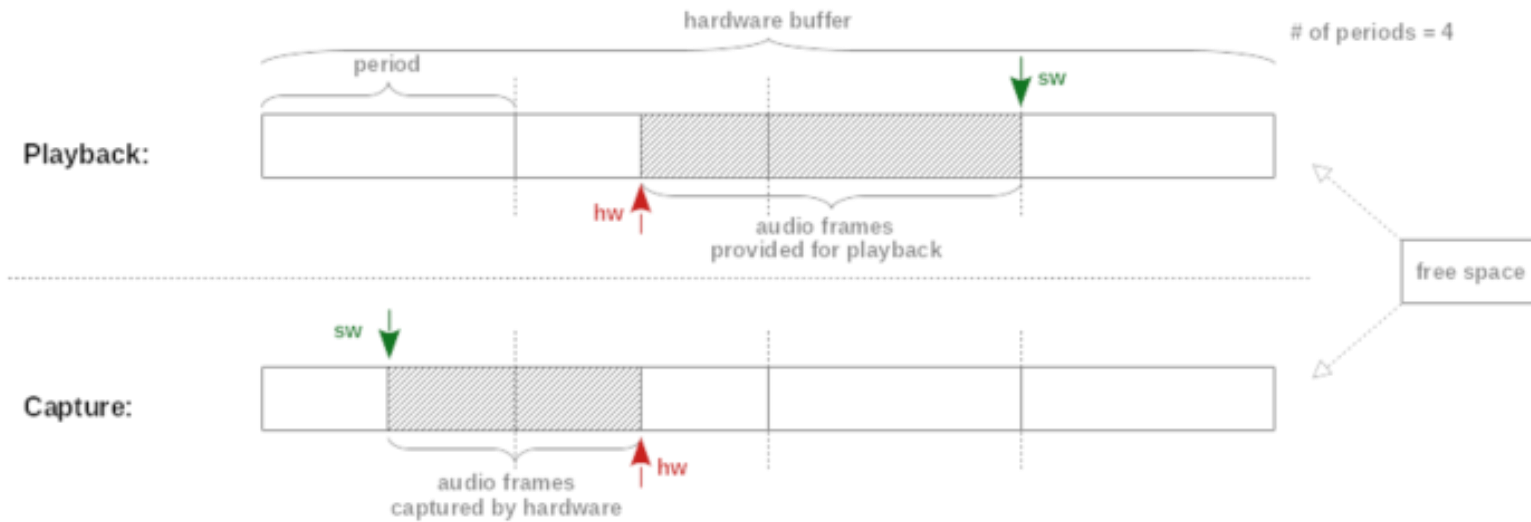
Virtual Audio basics

- **Allow virtual machines to access audio streams**

  - playback stream for sound reproduction

  - capture stream for sound capturing

  -

- **Challenges**

  - Don't stop

  - Don't interrupt

  - Low latency

  - Short stream startup time
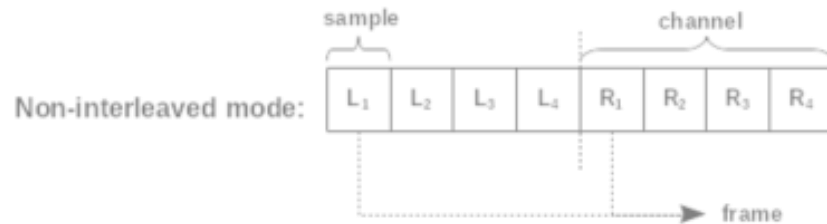
  - Enable hardware offloading

Audio Buffer basics

Visualization of stereo (2-channels) audio playback

Right hardware audio output

Left hardware audio output

Audio track

Audio channel

Audio sample R_n

Audio sample R_{n+1}

Audio sample R_{n+2}

...

Audio frame

Audio sample L_n

Audio sample L_{n+1}

Audio sample L_{n+2}

...

t_n t_{n+1} t_{n+2} t_{n+3} Time

Audio Buffer basics

Audio Buffer basics

Visualization of in memory layout for stereo (2-channels) audio frames

Interleaved mode:

sample							
L_1	R_1	L_2	R_2	L_3	R_3	L_4	R_4

frame

Non-interleaved mode:

sample				channel			
L_1	L_2	L_3	L_4	R_1	R_2	R_3	R_4

frame
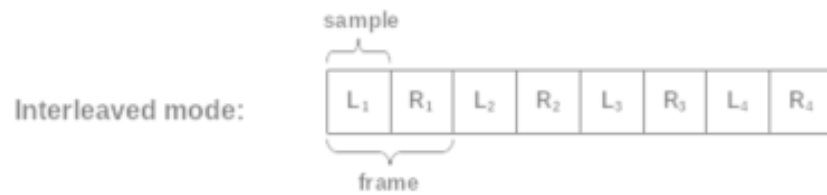
Virtualized device Architecture with VIRTIO

Device Guest (Client VM)

Linux/Android user space

Plumbing

ALSA

Linux kernel space

virtio-snd

virtio_mmio

Device Virtualization Framework

VQ

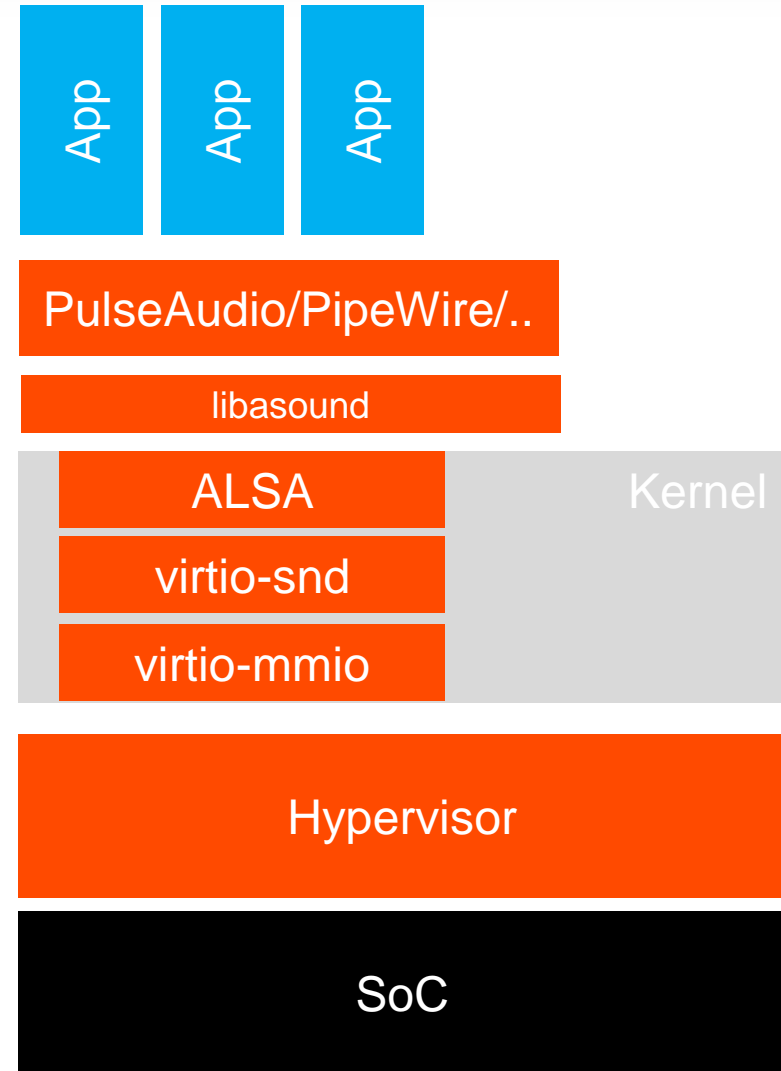SG list

PCM Buffer

Ref

Ref

Client VM Memory
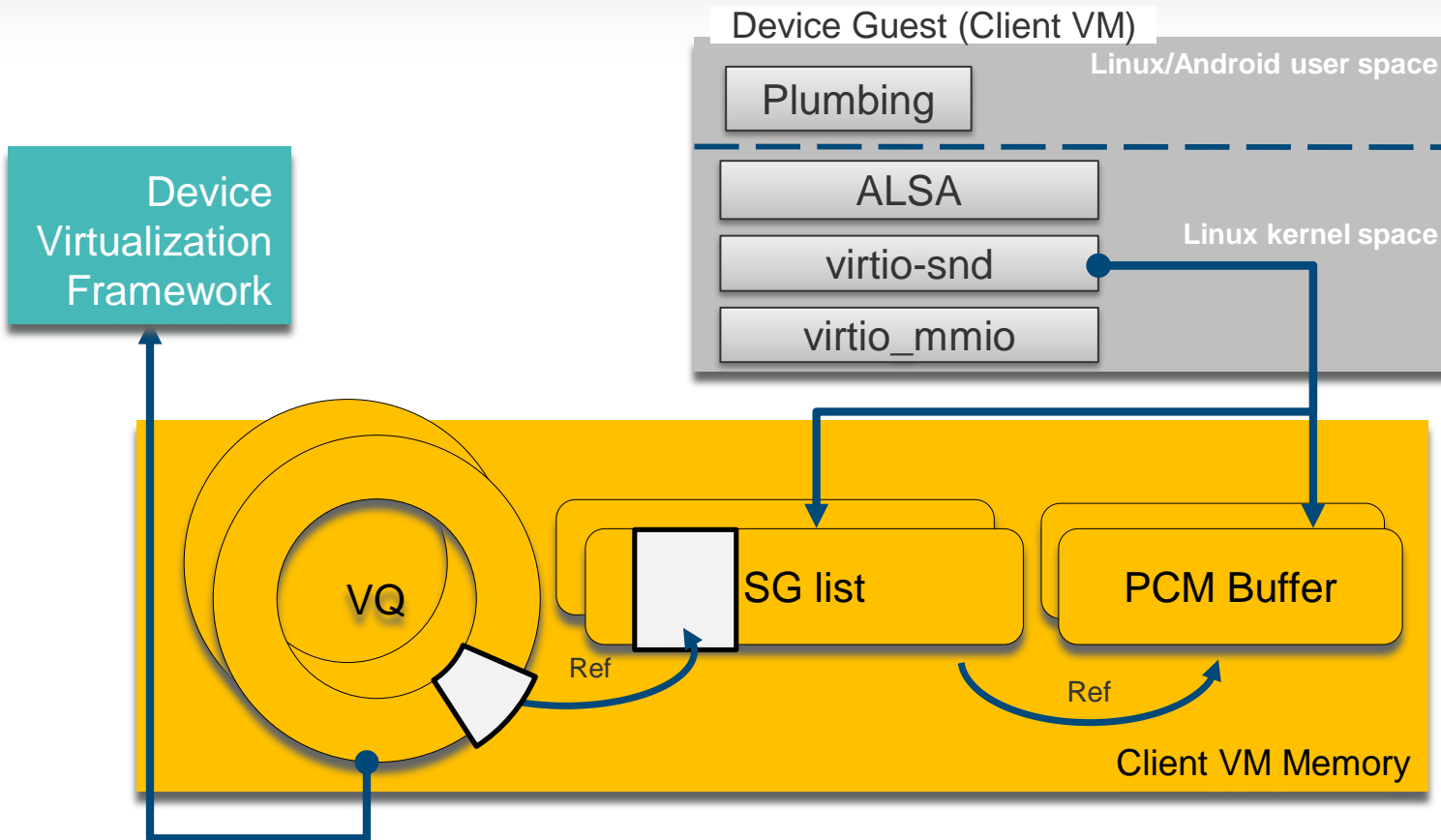
One queue for control (channel discovery, capabilities, etc)

One queue per channel, input and output are interleaved

- One channel is the set of coherrent streams
- If multiple incoherrent streams are needed, add more devices

VQ=virt-queue
SG=Scatter Gather

Linux Driver Stack

- **Implements alsa driver model**

  - Highly flexible

  - Dynamic probing to make hardware capabilities available in the guest

App

App

App

PulseAudio/PipeWire/..

libasound

ALSA

Kernel

virtio-snd

virtio-mmio

Hypervisor

SoC

Outlook

- **Spec currently on virtio-devel mailingslist**

    – Discussions still ongoing

- **PoC is running**

    – With COQOS hypervisor running Linux on rcar

    – QEMU-ARM running Android

    – QEMU-KVM running Linux

    – QEMU-KVM running Windows 10

- **Linux kernel driver RFC patchset will be posted shortly**

- **QEMU reference implementation to follow**

![OPENSYNERGY]
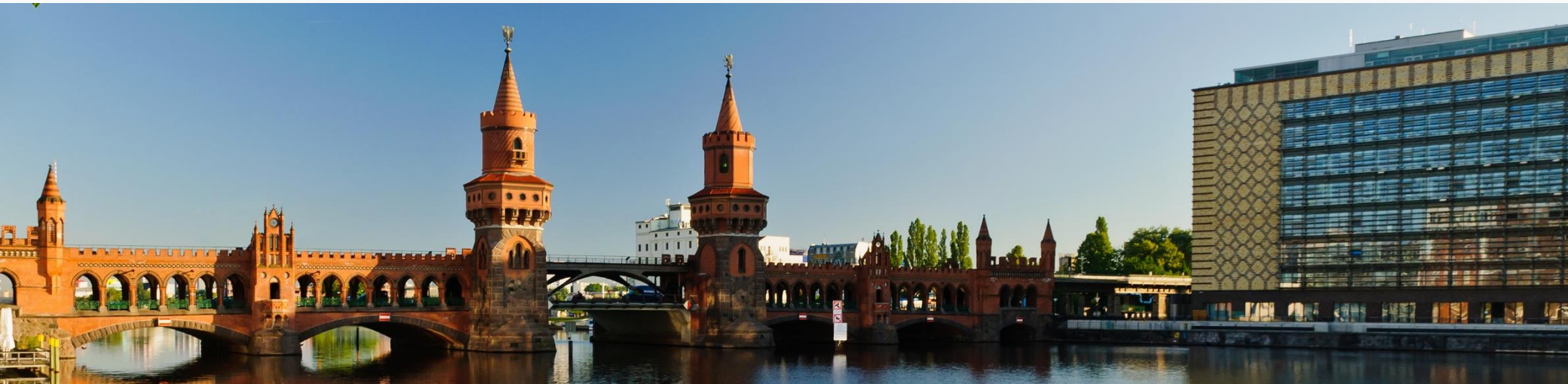
Headquarter   Further Locations

Berlin

OpenSynergy GmbH

Rotherstraße 20
D-10245 Berlin
Germany
Phone   +49 30 / 6098 5400

Munich

OpenSynergy GmbH

Starnberger Str. 22
D-82131 Gauting / Munich
Germany
Phone: +49 89 / 2153 9073

Utah

OpenSynergy, Inc. (USA)

765 East 340 South
Suite 106
American Fork, Utah 84003
USA

California

OpenSynergy, Inc. (USA)

501 W. Broadway, Suite 832
San Diego, California 92101
USA
Phone +1 619 962 1725

Shanghai

OpenSynergy GmbH

2608, Enterprise Square
228 Mei Yuan Road
Shanghai
P.R. of China
Phone: +86 132 6277 7738

E-Mail   info@opensynergy.com
Web   www.opensynergy.com