



Automotive Grade Linux IC Sound Manager - Collabora offer

December 8th 2020

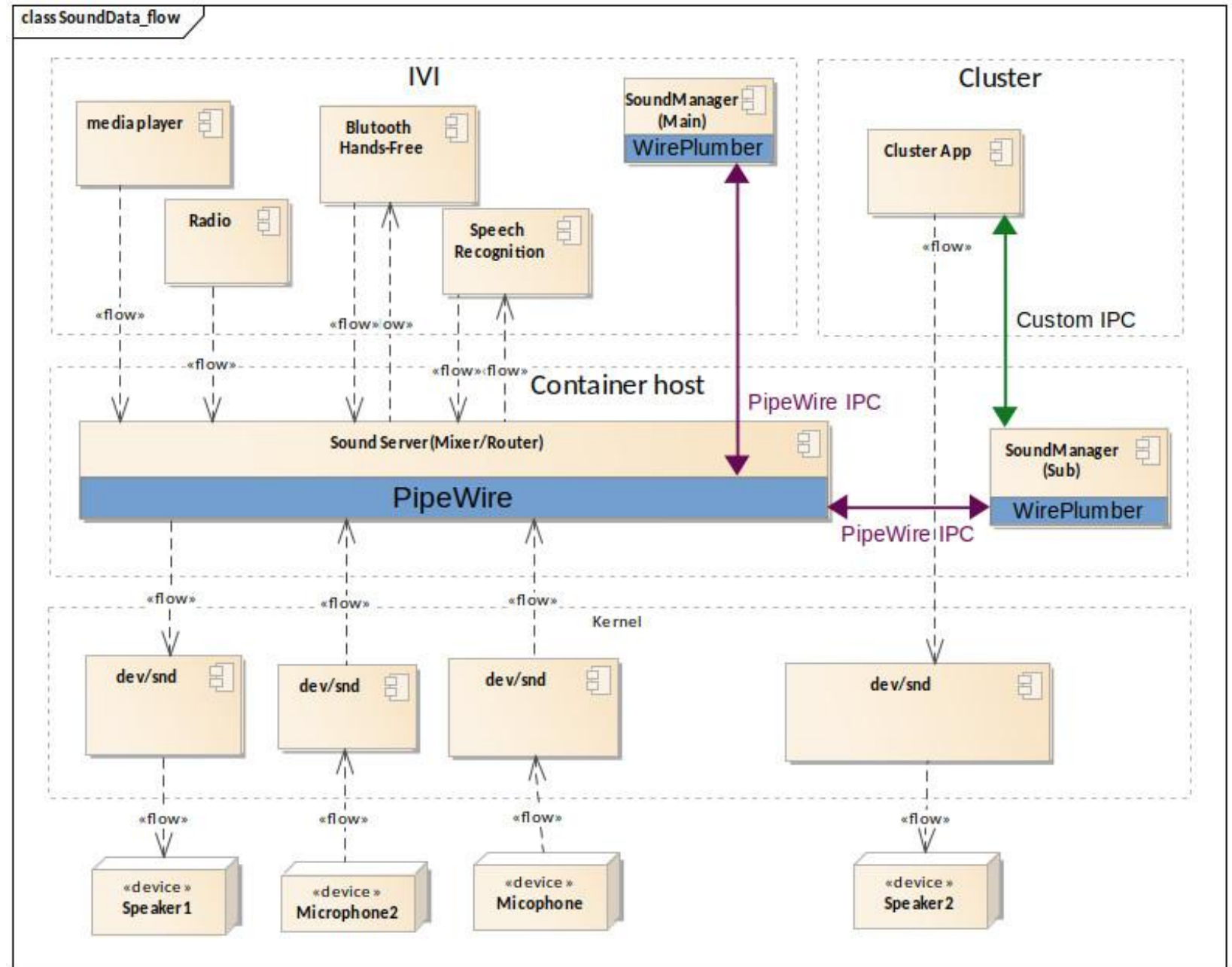
 THE **LINUX** FOUNDATION

Project Goals

- › Instrument Cluster Expert Group (IC-EG) seeking audio solution for IC use cases
- › Audio management to be container aware
- › IC applications to access audio hardware directly
- › Compatible with IVI running multiple applications
- › Audio device handling
- › Audio policy management

Proposed Architecture

- › Builds on AGL IVI work
- › Upstream ready
- › Extensible design
- › Policy driven
- › Secure



Sound Manager <=> PipeWire Session Manager

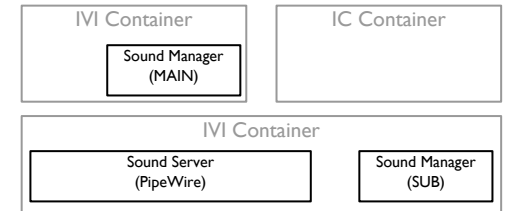
- › Monitors, initializes and configures Devices
- › Sets up Nodes (Format, Ports, etc...)
- › Creates/destroys/manages links based on its policy logic
 - › Links: client to device, client to client, optional filters in between
- › Implements access control, grants permissions to clients (applications)

Multiple session managers

- › Not an issue, PipeWire design supports such implementations
- › Session managers easily made aware of each others
 - › Responding to different events
 - › Managing different objects
 - › Applying policy for different things
- › Native PipeWire IPC communication between them

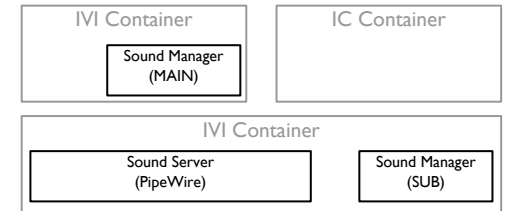
Communication

- › Native connections via PipeWire IPC wherever possible
 - › Sound Server <> Sound Manager (main)
 - › Sound Server <> Sound Manager (sub)
- › New protocol specific for Cluster applications
 - › Cluster applications to interface with “Sound Manager (Sub)”
 - › UNIX domain socket, passed through to the Cluster container
- › No direct connection and/or interaction between Cluster and the “Sound Server”

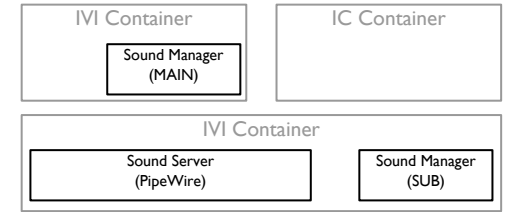


Security

- › Extensive security model within existing PipeWire implementation
- › Sound Manager (sub), running on host, to be granted full access to PipeWire
- › Sound Manager (sub) responsible to
 - › manage high-level object permissions
 - › grant restricted access to Sound Manager (main)
 - › initialize ALSA devices in PipeWire



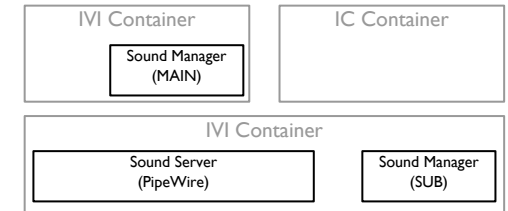
Security (cont'd)



- › Sound Manager (main), running on IVI, to have restricted access to PipeWire
 - › no access to ALSA controls
 - › no access to Sound Manager (sub)
- › Sound Manager (main) responsible to
 - › manage permissions of clients running on IVI container
- › Peripheral devices may be owned/managed by Sound Manager (main)
 - › ex. Bluetooth Hands-Free sets

Policies and policy actions

- › Policy management
 - › Dedicated policies and policy manager for IVI applications
 - › Dedicated policies and policy manager for IC applications
 - › Policies by the IC policy manager (Sound Manager (sub)) always have priority
- › No need for either Sound Managers to interact with each other's applications
- › Sound Manager (Sub) has full control of ALSA devices



Sound Processing

- › Sound Server to handle audio mixing when necessary
- › PipeWire IPC exposes interfaces for individual volume control and mute
- › Equalizer controls out of scope from initial project
 - › Could be added through software plugins or external hardware equalizers
- › Other plugins are supported by PipeWire however recommended to be out of scope for this initial version
- › Sound Processing through Sound Server should focus on key features initially

Summary of Proposed Work

- › Update PipeWire recipes in UCB and IC software baselines
- › Update app framework volume control interface (agl-service-audiomixer)
- › Update Bluetooth functionality to use PipeWire's native bluez plugin
- › Rebuild AGL's IVI policy on top of the latest Lua scripting policy engine
- › Test and verify CES 2020 Demo functionality (i.e. ensure no regressions)

Summary of Proposed Work (cont'd)

- › Setup environment with IVI and cluster containers
- › Get two instances of WirePlumber to work together (configurations adjustments)
- › Build security policy on the "Sound Manager (Sub)" instance
- › Integrate with the IVI container; address any container barrier issues
- › Implement Cluster app - WirePlumber communication link
- › Implement endpoints for cluster app & cluster ALSA device
- › Build device arbitration policy on the "Sound Manager (Sub)" instance
- › Adjust "Sound Manager (Main)" policy to handle events from "Sound Manager (Sub)"
- › Integrate Bluetooth audio with this new policy

Summary of Proposed Work (cont'd)

- › Make “Sound Manager (Sub)” resilient to crashes / stops of other components
- › Integrate with AGL’s build system for IC
- › Upstream of PipeWire & WirePlumber changes
- › Unit tests for arbitration policy
- › Unit tests for security policy
- › Unit tests for Cluster – WirePlumber communication
- › Create test application(s) forIVI and IC
- › Create test scripts to test system as a complete solution
- › Optimize to meet latency requirements (if needed)

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