Automotive Grade Linux
IC Sound Manager - Collabora offer

December 8th 2020
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
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
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) for IVI and IC
Create test scripts to test system as a complete solution
Optimize to meet latency requirements (if needed)
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