Introduction of Oct 19
Software Defined Vehicle Sessions

Oct 19, 2022
AGL F2F Workshop @Tokyo
<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speakers</th>
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<tbody>
<tr>
<td>11:00~11:05</td>
<td>Introduction of Overall Agenda</td>
<td>Jerry Zhao - Panasonic</td>
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<tr>
<td>11:05~12:00</td>
<td>Guest Speech: Software Defined Vehicle and OSS as key enabler for SDV - SBD Automotive</td>
<td>Masahiro Otsuka - SBD Automotive</td>
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<td>12:00~13:00</td>
<td>Lunch</td>
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<td>13:00~14:15</td>
<td>SDV Technology Enablers in AGL - Virt-EG Update on VirtIO</td>
<td>Jerry Zhao - Panasonic</td>
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<td>Mikhail Golubev - OpenSynergy</td>
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<td>Michele Paolino - Virtual Open Systems</td>
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<td>Atsuya Nasu - Panasonic</td>
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<td>14:15~14:30</td>
<td>Break</td>
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<td>14:30~15:30</td>
<td>SDV Technology Enablers in AGL - Container-EG Update on Container</td>
<td>Ilic Nenad - AWS</td>
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<td>15:30~16:00</td>
<td>Break</td>
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<tr>
<td>16:00~17:00</td>
<td>Guest Speech from SOAFEE/ARM: Software Defined AGL</td>
<td>Rod Watt - ARM</td>
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*VirtIO & Containers* enables software (applications) to be decoupled from hardware.
Guest Speech from SBD Automotive - The Software Defined Vehicle and OSS

Oct 2022

Masahiro Otsuka, SBD Automotive
VirtIO - A Common Device Framework to Achieve Software Defined Vehicle

Oct 2022
AGL Virtualization Expert Group Leader
Jerry Zhao, Panasonic Automotive Systems Co., Ltd.
About AGL Virtualization Expert Group

• Start of the Expert Group:
The expert group was created from a BoF held in the Munich AGL AMM 2016 meeting and started activities from 2017.

• Responsibility:
The AGL Virtualization Expert Group (Virt-EG) is responsible to design and implement virtualization solutions for AGL.

• EG Members:
On average 10~20 members from different fields are joining the bi-weekly call. Panasonic started to serve as the leader of Virt-EG since 2020.

• Interest Points:
Hypervisors and device virtualization solution. Nowadays, Virt-EG is focusing on applying and extending standard device virtualization framework VirtIO for diverse AGL use cases to empower evolution to a Software-Defined AGL.
Device Virtualization for Software Defined Vehicle
Cockpit Digital Transformation

Cockpit is going to be filled with digital instruments.

Excerpt from Panasonic’s Keynote Presentation at the AGL AMM July 2020
Device Virtualization: Specific Necessity in Automotive

**Common abstraction of diverged devices among car models and location transparency of devices** are especially critical for application software asset.

- Diversity of Devices due to Various Car Models
- Highly Distributed Architecture
- Conflicts between optimized allocation policies of applications and devices

Excerpt from Panasonic’s Keynote Presentation at the AGL AMM July 2020
Common abstraction of diverged devices among car models and location transparency of devices are especially critical for application software asset.

- Even for centralized ECU, the same argument applies because the system inside is divided to multiple VMs

Excerpt from Panasonic’s Keynote Presentation at the AGL AMM July 2020
Common abstraction of diverged devices among car models and location transparency of devices are especially critical for application software asset.

- In addition, same issue will apply to Virtual ECU constructed in Server/Cloud where has completely different device natures from the one on the automotive edge.
Device Virtualization: Key to Software Defined Vehicles

Software Defined Vehicle needs a common device virtualization framework to decouple software implementation from diverse hardware targets across vehicle variants/generations, architectures (single/multiple-ECU) and development environments (real/virtual ECU)
VirtIO as A Common Device Virtualization Framework
Overview of Device Virtualization in AGL - Concept

Device Virtualization with VirtIO benefits in establishing a complete and healthy ecosystem for AGL to enhance interchangeability and interoperability in various scenarios.

- **Hypervisor Environment**
  - Host VM
  - AGL
  - VirtIO
  - SoC

- **Non-Hypervisor Environment**
  - AGL
  - VirtIO
  - SoC

- **Multi-ECU Environment**
  - AGL
  - VirtIO
  - SoC

- **Cloud Environment**
  - AGL
  - VirtIO
  - Emulated Device

Mikhail from OpenSynergy (15min)
Michele from Virtual Open System (15min)
Nasu from Panasonic Automotive (15min)
Jerry from Panasonic Automotive (5min)
VirtIO on Hypervisor

• Presenter: Mikhail Golubev, OpenSynergy
• Slides: Virtual I/O (VIRTIO) based virtualization in AGL
VirtIO on Non-Hypervisor

• Presenter: Michele Paolino, Virtual Open Systems
• Slides: Virtio-loopback: a common device interface between Virt-AGL and Non-Virt AGL
VirtIO on Multi-ECU

• Presenter: Atsuya Nasu, Panasonic Automotive Systems Co., Ltd.
• Slides: Introduction of UnifiedHMI
VirtIO with Cloud-Native AGL

Jerry Zhao, Panasonic Automotive Systems Co., Ltd.
VirtIO with Cloud-native AGL

Utilize VirtIO as a well-defined device HAL even for non-virt AGL may further help to reduce fragmentation across SoCs and encourage “AGL-ready BSP”

Maximized commonality of AGL Software among SoCs, virt/non-virt, cloud/non-cloud environment

Use VirtIO as Common I/F with Cloud-based AGL to enhance interchangeability between cloud-AGL and native-AGL

Proprietary Device Drivers A
SoC A

Proprietary Device Drivers B
SoC B

Proprietary Device Drivers C
SoC C

Emulated Device
Local/Cloud Server

Develop & Test in Cloud
Deploy in Native (Real HW)
Virtual AGL Running On MacBook

- EG Member Francois from the company Shokubai has created a demo to run the AGL with VirtIO on the top of MacBook with Apple MacOS 13 virtualization framework.
- This can be done without any changes to AGL thanks to VirtIO.

https://www.youtube.com/watch?v=5DT-l2sWeVY
Cloud-native AGL Work between Virt-EG & Container-EG

- Establish a reference environment of cloud-native AGL
- Make VirtIO & Orchestration work on both cloud and edge AGL instances, and enable developer to develop HMI services on cloud environment which graphic & audio can be verified on local clients
- Organize demos & presentations and contribute work to AGL

Instrument Cluster & IVI which are most related to UI/UX and need rapid development & OTA are one of the automotive devices that enjoy benefits from cloud-native most.
Advance Notice: Step 1 MVP to be shown in CES AGL Booth

Thanks to **VirtIO**, same AGL binary is working on both AWS Cloud (Graviton) and AGL Reference Hardware.
Closing Mark
Overview of Device Virtualization in AGL - Summary

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<tr>
<th>Hypervisor Environment</th>
<th>Non-Hypervisor Environment</th>
<th>Multi-ECU Environment</th>
<th>Cloud Environment</th>
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<tbody>
<tr>
<td>Host VM</td>
<td>AGL</td>
<td>AGL</td>
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<td>AGL</td>
<td>VirtIO</td>
<td>AGL</td>
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<tr>
<td>SoC</td>
<td>SoC</td>
<td>SoC</td>
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<tr>
<td>Virtual IDE</td>
<td>Other OS</td>
<td>Other OS</td>
<td>Emulated Device</td>
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(Steady Progress) Most of basic & multi-media device for common use case has been supported in AGL. Further extension and support for more advanced use case in progress.

(Activity started) Detailed design of loop-back features have been done and under review from EG members. Move to virtio-blk and virtio-input support next.

(Activities Started) Already have an open source github for “Unified HMI” (Virtual Display) and starting work to integrate with AGL UCB aiming at OO/PP.

(New Activities) Being work together with container-EG and going to show demos in ALS/CES.
Welcome to AGL Virt-EG

Join the AGL Virt-EG biweekly call to discuss and contribute to define the future of automotive together with us!

https://wiki.automotivelinux.org/eg-virt
Q&A
Guest Speech from ARM: Software Defined AGL with SOAFEE

Oct 2022

Rod Watt, ARM