Instrument Cluster EG Discussions

AGL Virtual Work Shop
2021/10/20
IC EG Development Group
Outline

• Background
  • What is Instrument Cluster Expert Group
  • Our Concept

• Status Update
  • Early stage development

• Discussion Point
EG scope and system image?

**Cluster centric system**

- **Low grade**
- **Hi grade**

**IC EG target**

**Cluster(HUD)**

+ **Smart phone connection(SDL..)** for small IVI function

**IVI centric system**

- **Hi grade**
- **Hi spec**
- **Low spec**

**IVI function**

- **Cluster(HUD)**
- **Smart phone connection(SDL..)**

**Cluster function**
Puzzles in automotive quality management

- There are many puzzles in the automotive system (main function).

**IVI**

- Rapid innovation
  - New features are added
  - Short-term development
  - Rapid bug fixes

**Instrument Cluster**

- Advanced quality management
  - Full path coverage testing
  - Formal verification
  - Careful bug fixes

- Selected functions
  - Combinational verification
  - Fast boot-up

- Various functions
  - Many pre-installed applications
  - Applications installed from store

Puzzle
QM Isolation

- Our answer to the puzzle issues is “one more isolation method" which takes one-more layer to isolate the functions by using Linux container technology.

Abstract architecture

For verification
Selected software properly tested by full-path coverage test and formal verification.

For rapid innovation and bug fixes
Runtime environment is isolated from other software stacks by container to realize rapid innovation.

Main functions are isolated according to their QM level, booting time, incident type, etc.
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Early stage development

• IC EG member created 1st architecture in last year.
• This year, IC EG member start development.
  • We call early development to it.

• What we aim
  • Create development base environment for next development.
Container Integrations

• Container integration support into AGL
  • Limited container host and cluster container are available
  • Display isolation feature is available
  • Demo GUI is available
Limited container host and cluster container

- It support single step integration both host and guest using Yocto multi config.
  - When we execute build, we can build host and guest software stack.
    - ex. bitbake lxc-host-image-demo

- It success to reduce kernel functions partially.
  - Existing AGL enabled much kernel functions in default, because many demo feature need demo specific kernel functions.
  - We changed -
    - The demo specific kernel functions is only enabled in demo feature enabled, it is not enable by default.
  - It need to continue this work.

- 1st release support R-Car Gen3 environment only.
Display isolation feature

- Display isolation feature is realized by drm-lease feature.
  - We integrated lease manager into container host.
  - It realize one container by one compositor architecture using drm-lease kernel function.
  - OpenGL drawing and compositing is available in cluster container.
  - Currently not support hardware compositor, because it highly depend on BSP.
Architecture Overview for MM

- Use existing AGL (already merged)
- Disclose by AISIN (re-use CES2020 demo soft, will not maintain)
- Target for y2021 AGL dev. RFQ
- Now working by FCT
- SMC

Demo usecase
- Cluster and IVI run on one Linux.
- Both guest have own compositor, powered by drm-lease.
- When Cluster play buzzer, IVI sound is muted by pipewire.
- Cluster GUI draw by pseudo signal deliver from IC Service.

Issue
- Existing AGL app-fw can’t integrate into guest container, it’s limitation of the existing implementation.
  This IVI guest focuses only demo. IVI guest will replace after new app-fw release.
- Need to check agl-compositoe is not depend to app-fw.
  - Not depend to agl-appfw. Can implement guest.
- Yocto multi-config require to more heavy work.
Current Integration status for local dev

- Adding a IVI guest
  - Example App was imported.
    - Navigation, Media player, Home screen bar
    - Only to UI displaying.
  - Weston with IVI extension was imported.
    - It use IVI side.
    - Simple layout manager was imported too.

- Adding a some IC software
  - IC service framework and API library was imported.

- Cluster display for demo is supported
  - 1920x720 60fps support

- Already created 33 patches now
  - 5 patch was submitted
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Issues

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• Guest image build require to BSP kernel building
• Need to add kernel patch before kernel 5.7
• How to support touch and other input device in guest
• Need to improve iccom stack
• How to support pipewire
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Guest image build require to BSP kernel building

• Initial discussions
Guest image build require to BSP kernel building

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Guest image build require to BSP kernel building

- Concluding initial discussions
  - Common understanding
    - AGL create and maintain Host/Guest specific BSP (only to additional recipe), that is heavy work.
    - In this case, we can’t support many boards. May be R-Car only.

- How to fix
  - Scott proposed to use Yocto multi config.
  - Current environment use it.
Guest image build require to BSP kernel building

• Current issue
  • Can’t build some user land library depend on kernel module header

• Initially we use linux-dummy in guest side
  • Can skip kernel building
  • Not installing kernel image

• In this case, some user land library can’t build in guest
  • In R-Car Gen3
    • vspmif-user-module, mmngr-user-module, etc..
    • These library require to header file deriver from kernel module

• How to Fix this issue?
  • My idea
    • BSP kernel and kernel module build in guest side.
      • https://gerrit.automotivelinux.org/gerrit/c/AGL/meta-agl-devel/+/26697
      • https://gerrit.automotivelinux.org/gerrit/c/AGL/meta-agl-devel/+/26699
      • https://gerrit.automotivelinux.org/gerrit/c/AGL/meta-agl-devel/+/26698
Guest image build require to BSP kernel building

- I get a some review comment
  - At https://gerrit.automotivelinux.org/gerrit/c/AGL/meta-agl-devel/+/26697

- Summarily
  - Scott
    - having userspace inside a container, even a system container, dependent on custom interfaces in the host kernel seems unsupportable long-term in a product IMO.

- My response
  - I agree to this point. Ideally case, that’s right. On the other hand, if we will not fix this issue, we need to re-development in downstream. In other board, may have same issue.

- When you have more good solutions, please advice to us
Guest image build require to BSP kernel building

• I get a some review comment
  • At https://gerrit.automotivelinux.org/gerrit/c/AGL/meta-agl-devel/+/26697/3

• Summarily
  • Jan-Simon Moeller
    • Another option is to apply
    • meta-agl-devel/meta-agl-lxc/recipes-platform/images/lxc-host-image-minimal.bb:NO_RECOMMENDATIONS = "1"
    • to the guest images as well.

• My response
  • I will test it. Now in task queue..
Guest image build require to BSP kernel building

• I get a some review comment
  • At [https://gerrit.automotivelinux.org/gerrit/c/AGL/meta-agl-devel/+/26699](https://gerrit.automotivelinux.org/gerrit/c/AGL/meta-agl-devel/+/26699)

• Summarily
  • Jan-Simon Moeller
    • Usually it is part of MACHINE_ESSENTIAL_EXTRA_RDEPENDS and some do IMAGE_INSTALL:append.
    • In case of rcar, we do it in our agl_rcar_nogfx.inc ... we can remove it there, which might solve the issue already. Just need to check why it is in there in the first place.

• My response in this time
  • I know agl_rcar_nogfx.inc cause this issue in case of R-Car. But if it remove, many image will lost dtb file...
  • This patch is only a workaround..
  • Who know why agl_rcar_nogfx.inc has DTB install description?
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Need to add kernel patch before kernel 5.7

• [https://github.com/agl-ic-eg/meta-agl-devel/commit/7d3bef593d2792b0939fc5653424b2cf322158f6](https://github.com/agl-ic-eg/meta-agl-devel/commit/7d3bef593d2792b0939fc5653424b2cf322158f6)

• In kernel upstream, firmware downloader is improved in 5.7.
  • In kernel 5.4, firmware downloader inherit mount name space. In this case we can't controlling which firmware is downloading.
  • In kernel 5.10, firmware downloader doesn't inherit mount name space. In this case we can controlling which firmware is downloading.

• This fix is important fix. I want to backport this patch to support containerizations. How do you think?
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How to support touch and other input device in guest

• Current IVI guest is not support input device
  • Weston use libinput to handle input device
    • libinput depend on libudev and udevd. Need to /var/run/udev/data/*
    • On the other hand, systemd-udevd can't work in guest.
  • In CES2020 demo, /var/run/udev/data/ was sharing both host and guest.
    • Umm…

• My idea
  • Use libudev-zero in guest
    • https://github.com/illiliti/libudev-zero
  • We success to trial in old environment.
How to support touch and other input device in guest

- When we use libudev-zero, need to remove libudev and systemd-udevd in guest. Because libudev-zero is a replacing library of libudev.
- In this case, we need to use heavy systemd bbappend....
- Do you know more better method?

**Libudev-zero recipe:**
Cross building patch is already merged.
https://github.com/illiliti/libudev-zero/pull/29

**Systemd recipe:**
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Need to improve iccom stack

• We import iccom (contributed by Bosch) in our development environment.
  • [https://github.com/agl-ic-eg/linux-iccom](https://github.com/agl-ic-eg/linux-iccom)
    • It’s our fork.

• Issue
  • Currently it’s not supporting name space.
  • Now it try to improve by EG member.
    • If you are expert for linux netlink stack, please help us.
    • If you know good material for netlink and that name space support, please let us.
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How to support pipewire

• Please help us....
How to access in EG development

• repo init -u https://github.com/agl-ic-eg/AGL-repo

• repo sync

• source meta-agl/scripts/aglsetup.sh -m h3ulcb-kf -b build agl-lxc
  • Need to Proprietary Drivers
    • Check LL version of “Building for Supported Renesas Boards” in AGL doc

• bitbake lxc-host-image-demo

• Attention
  • This repository is trial, too unstable. We will submit each patch into AGL gerrit.
  • IC guest is automatically boot up, IVI guest is not automatically boot up.
    • lxc-start –n ivi-demo