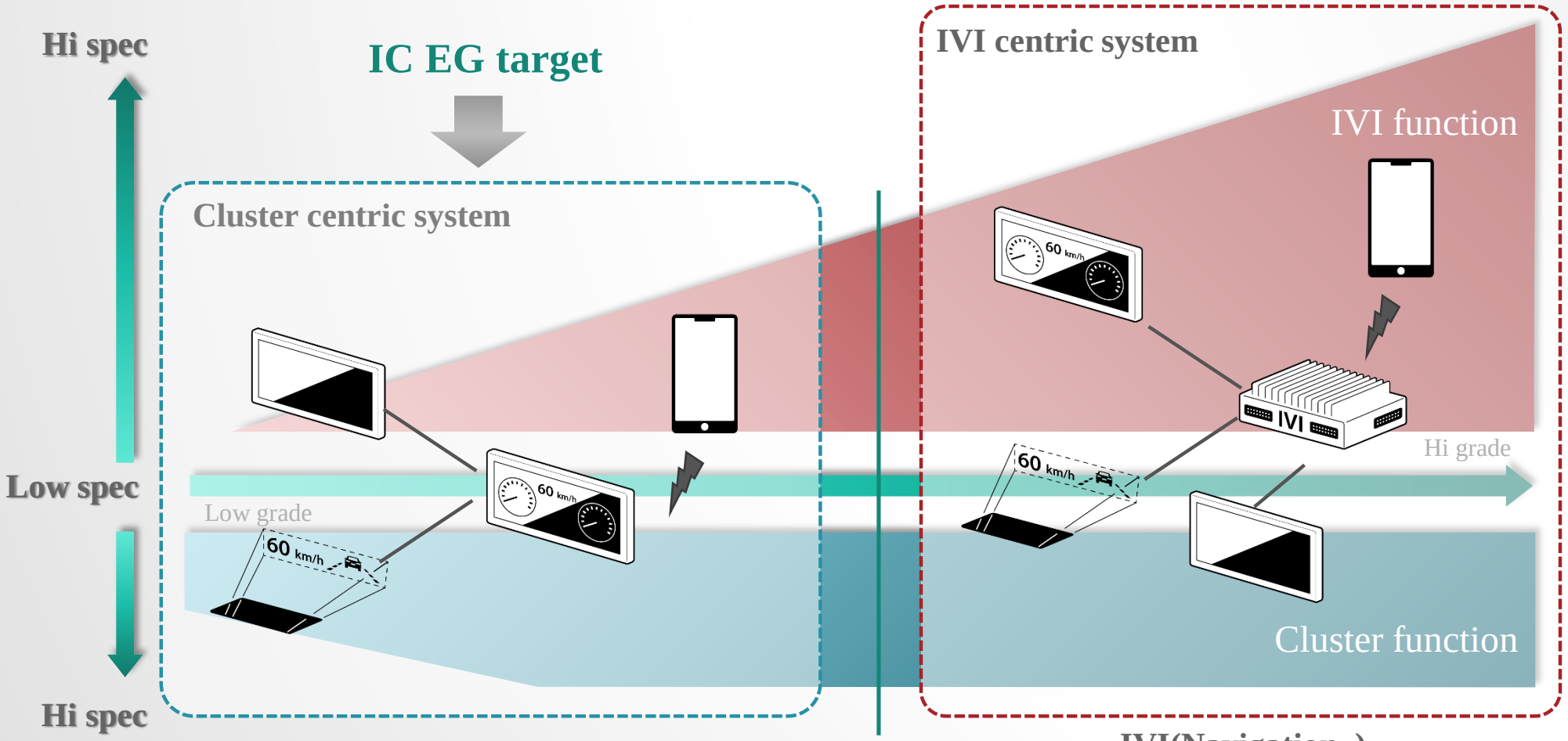
Instrument Cluster EG Discussions

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

IVI(Navigation..)
+
Cluster(HUD)
+
Smart phone connection(SDL..)

AUTOMOTIVE GRADE LINUX

Puzzles in automotive quality management

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

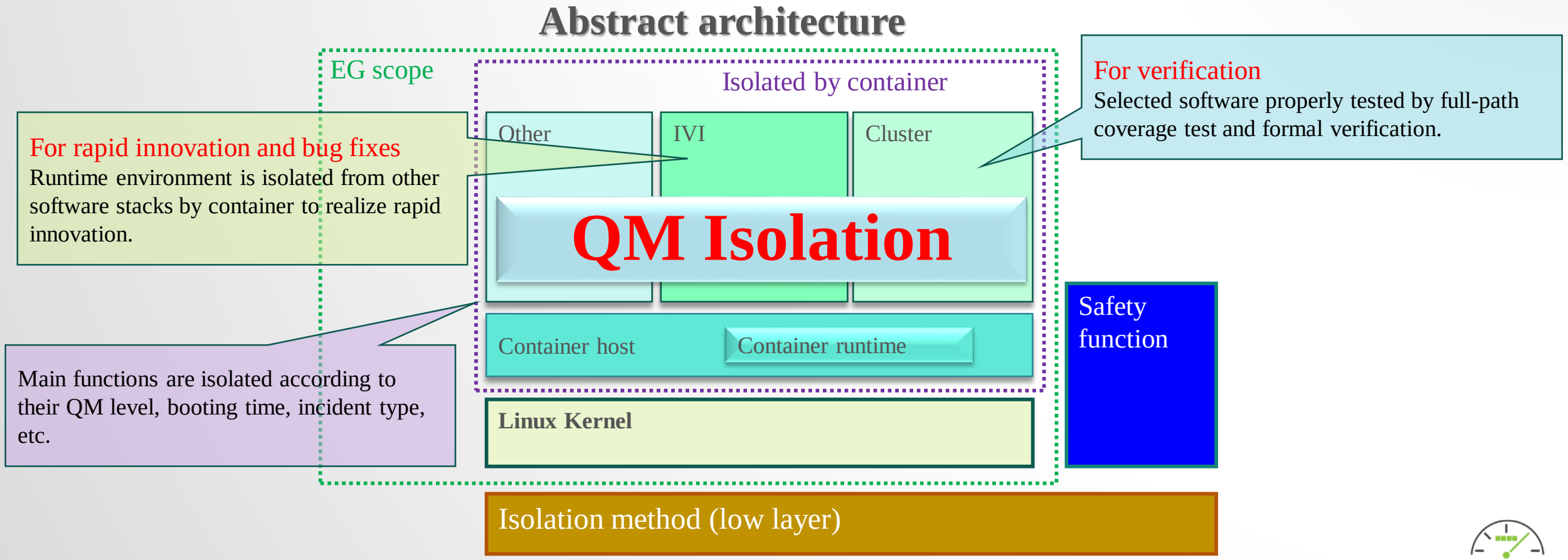
IVI	Instrument Cluster

• Rapid innovation
  • New features are added
  • Short-term development
  • Rapid bug fixes
	Puzzle
	• Advanced quality management
	  • Full path coverage testing
	  • Formal verification
	  • Careful bug fixes

• Various functions
  • Many pre-installed applications
  • Applications installed from store
	Puzzle
	• Selected functions
	  • Combinational verification
	  • Fast boot-up

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.



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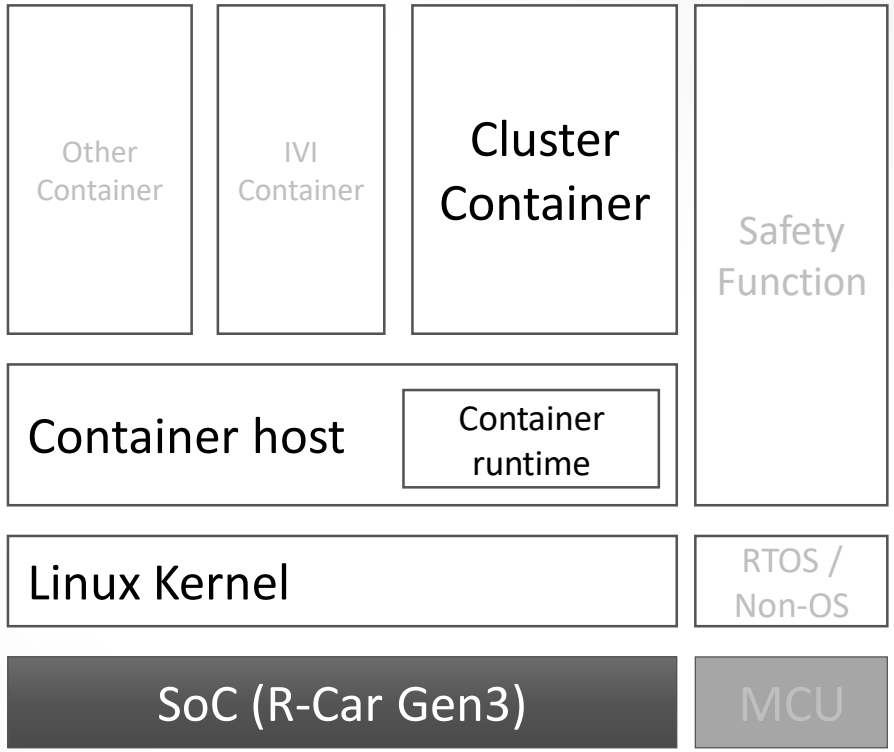
Early stage development

- 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

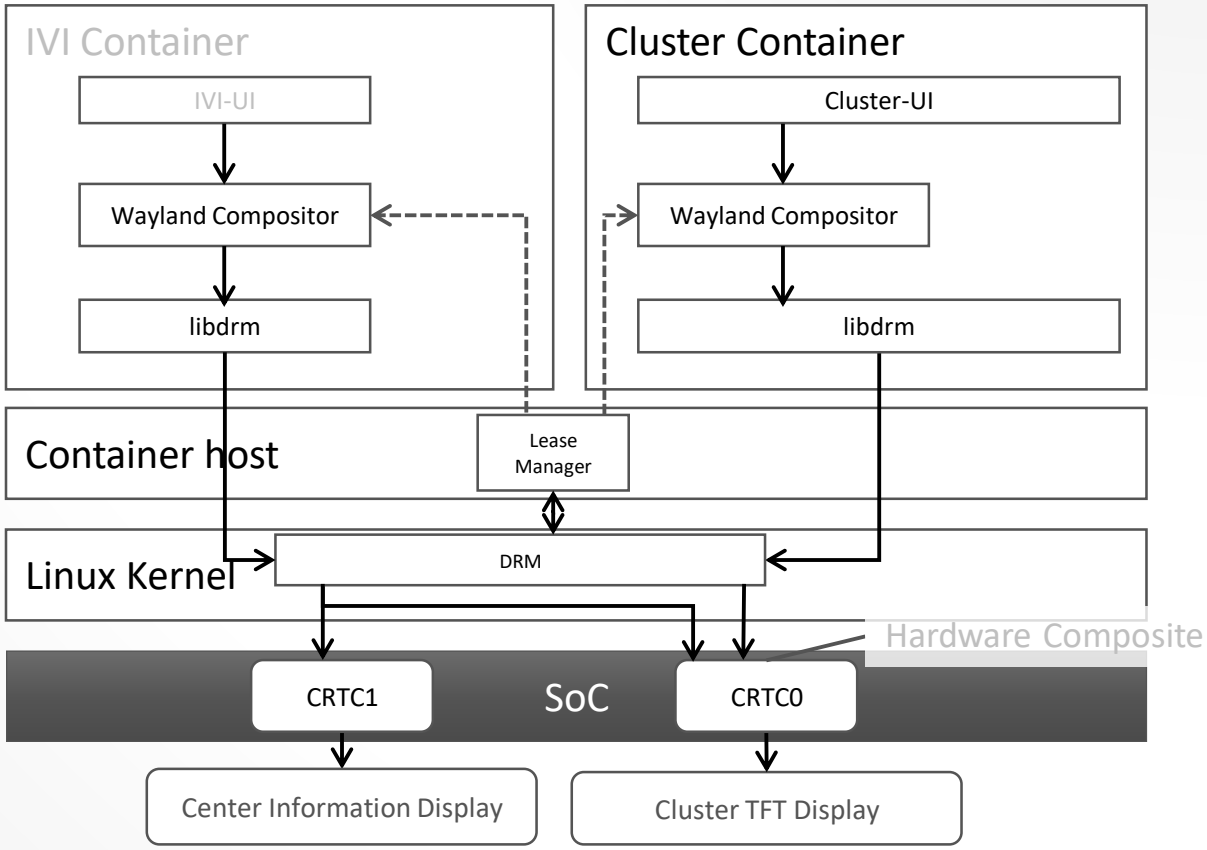


Limited container host and cluster container

- 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

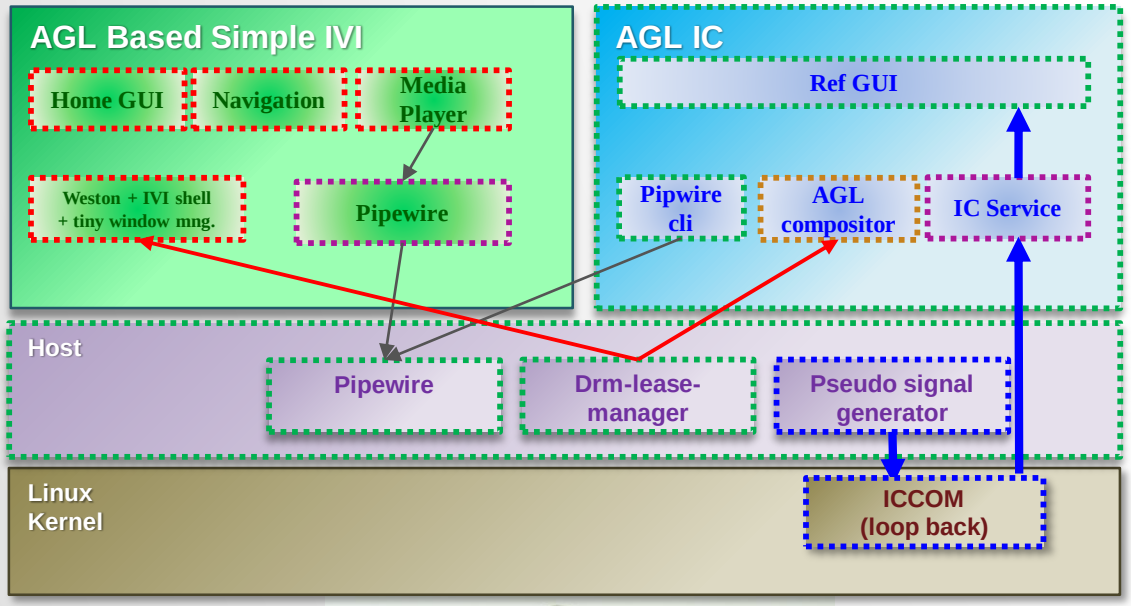
Use existing AGL (already merged)

Disclose by AISIN (re-use CES2020 demo soft, will not maintain)

SMC

Target for y2021 AGL dev. RFQ

Now working by FCT



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.

Infotainment Display 1920x1080

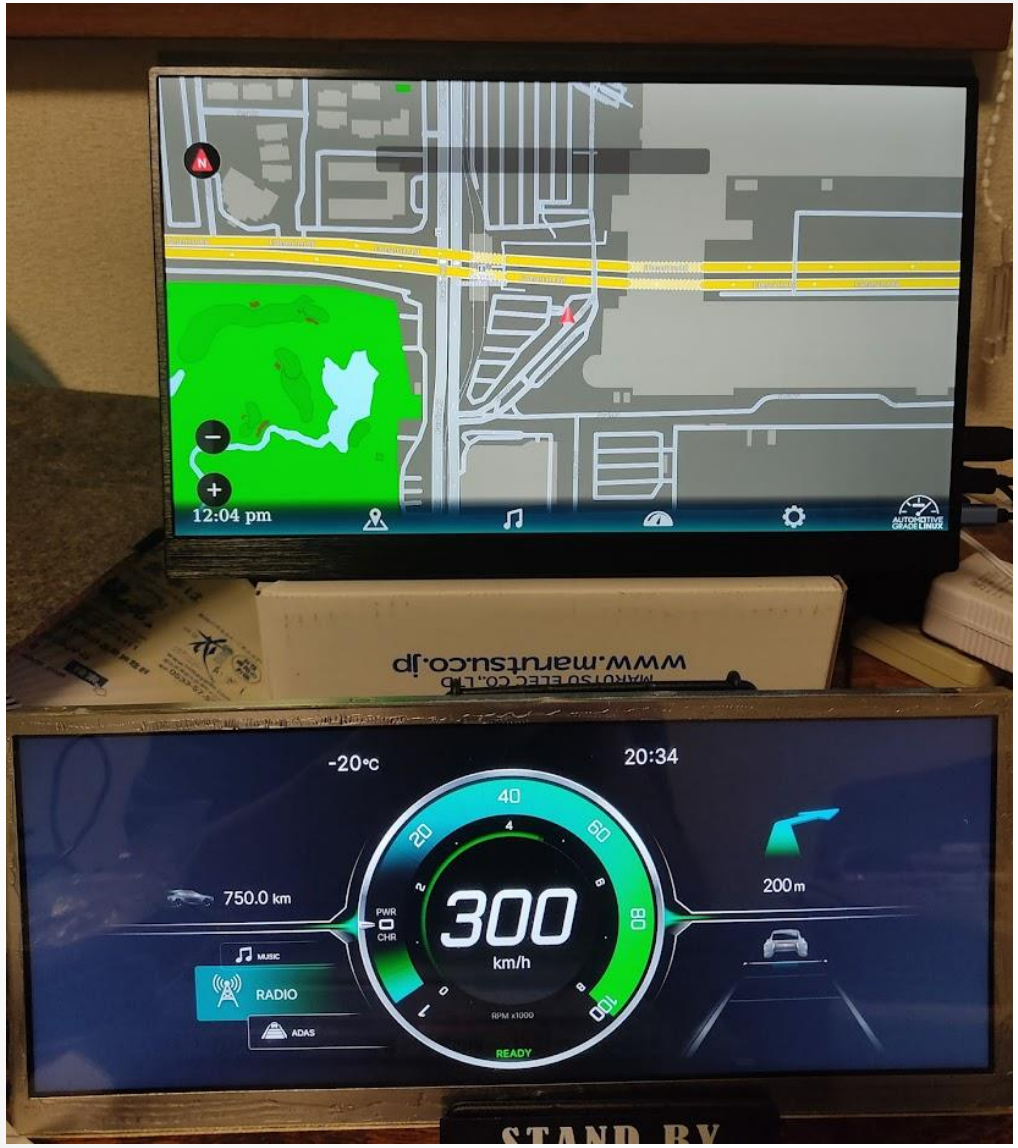
R-CarH3+Kingfisher

Cluster Display 1920x720

AUTOMOTIVE GRADE LINUX

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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  - 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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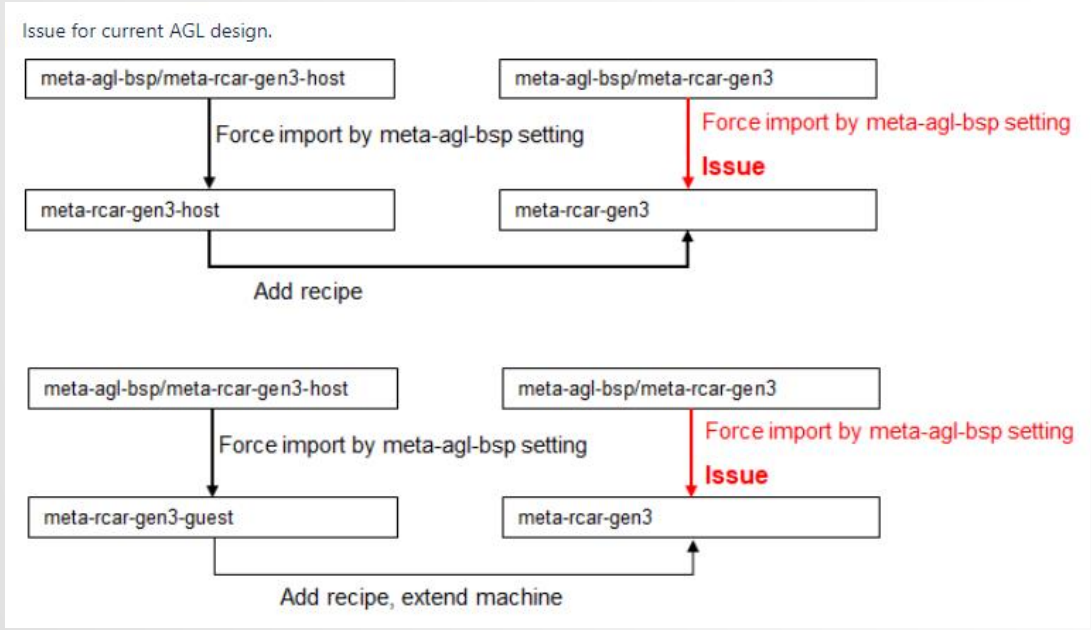
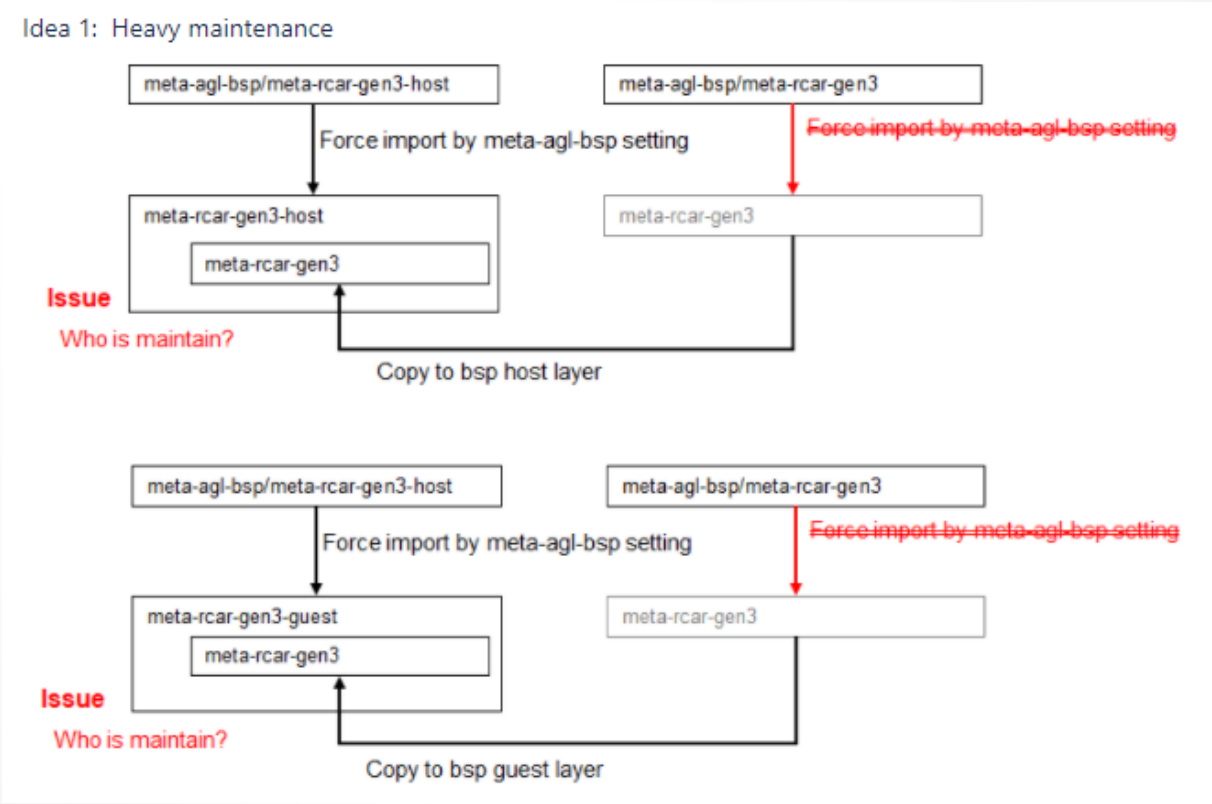
Guest image build require to BSP kernel building

- Initial discussions





Guest image build require to BSP kernel building

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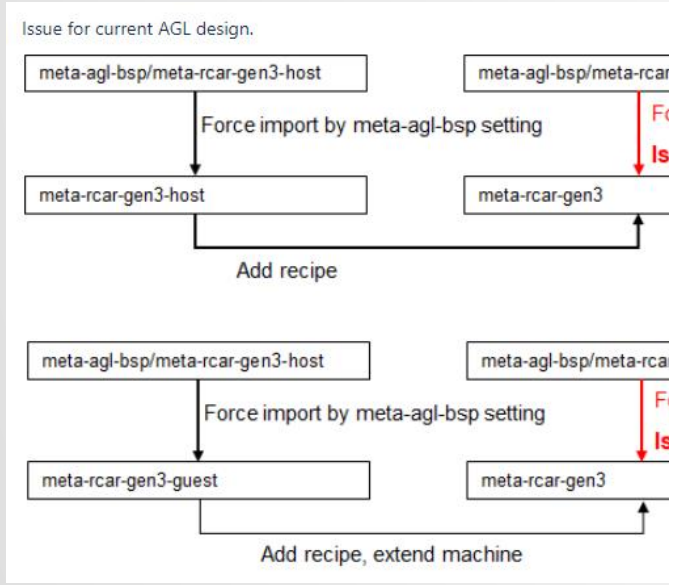

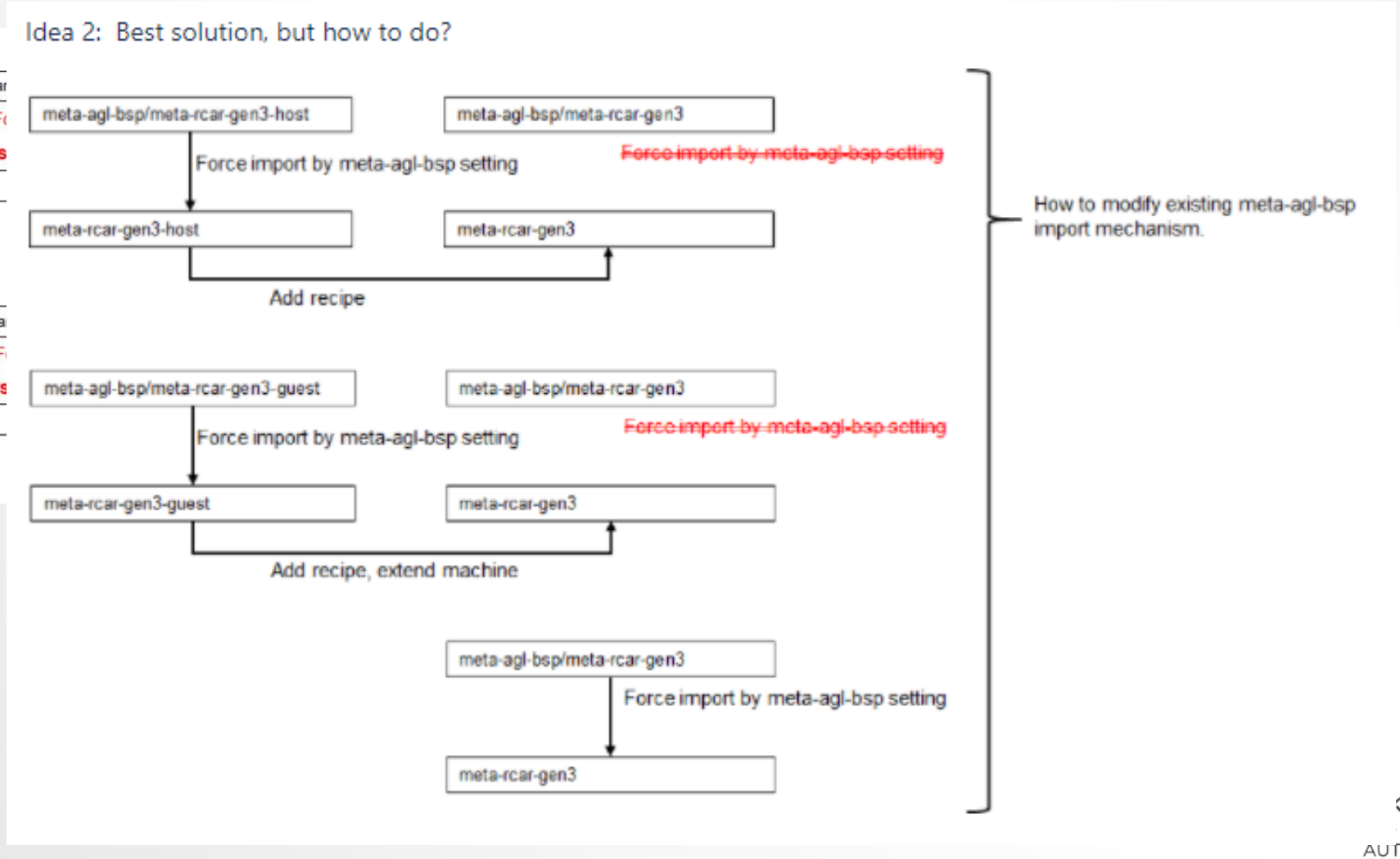

Guest image build require to BSP kernel building

- 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

  - 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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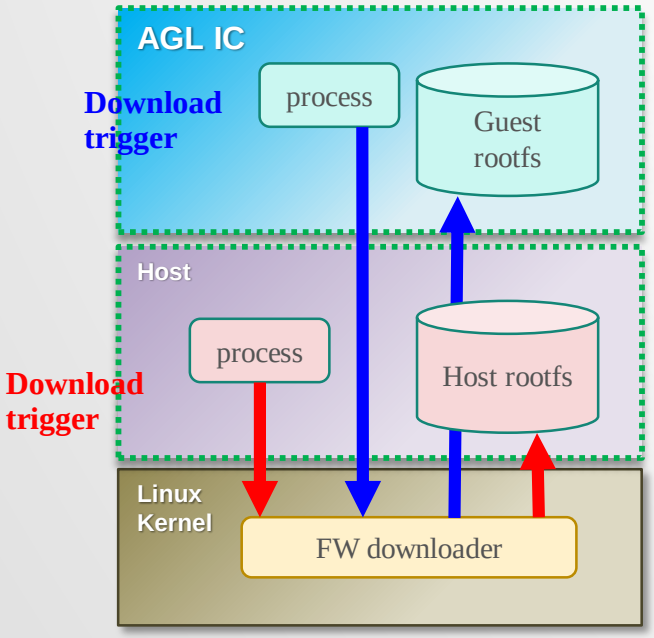
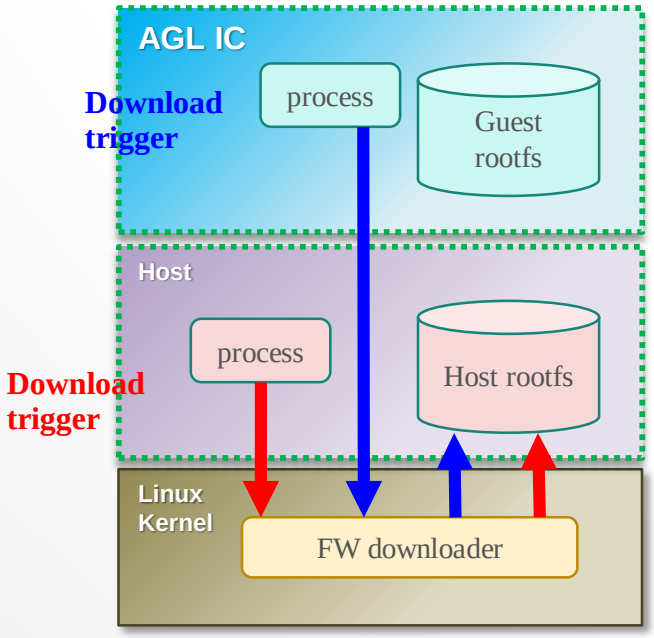
Need to add kernel patch before kernel 5.7

- https://github.com/agl-ic-eg/meta-agl-devel/commit/7d3bef593d2792b0939fc5653424b2cf322158f6
- 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?

Kernel 5.4 (before 5.7)



Kernel 5.10



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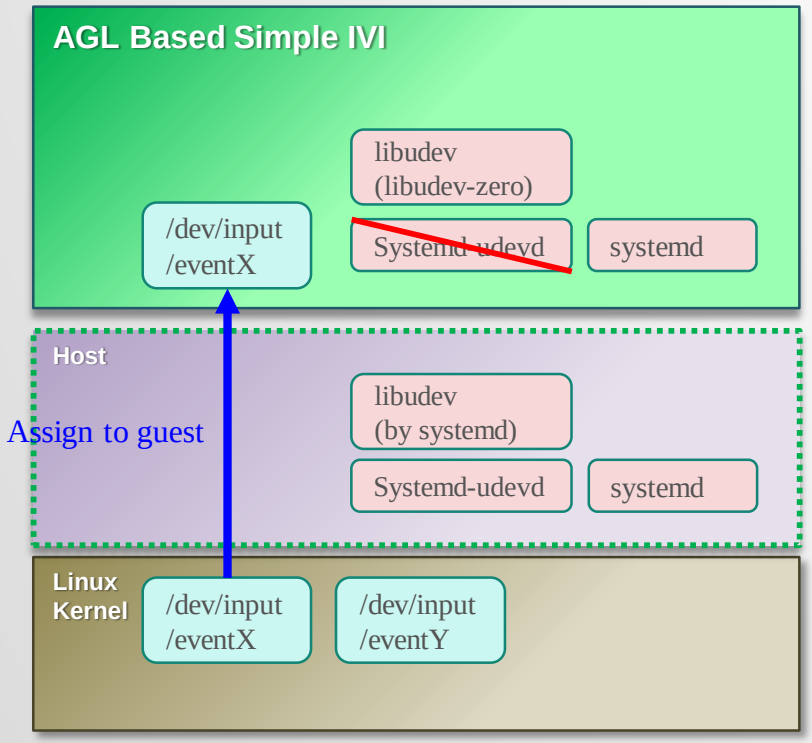
How to support touch and other input device in guest

- 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:
https://github.com/agl-ic-eg/meta-agl/tree/dev/meta-agl-ic/recipes-core/udev
Cross building patch is already merged.
https://github.com/illiliti/libudev-zero/pull/29

Systemd recipe:
https://github.com/agl-ic-eg/meta-agl/blob/dev/meta-agl-ic/recipes-core/systemd/systemd_%.bbappend

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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
    - 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

- Attentions
  - 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