Display and GPU Sharing Case Study

October 10th, 2018 | using Renesas R-Car H3 Canvas Demo

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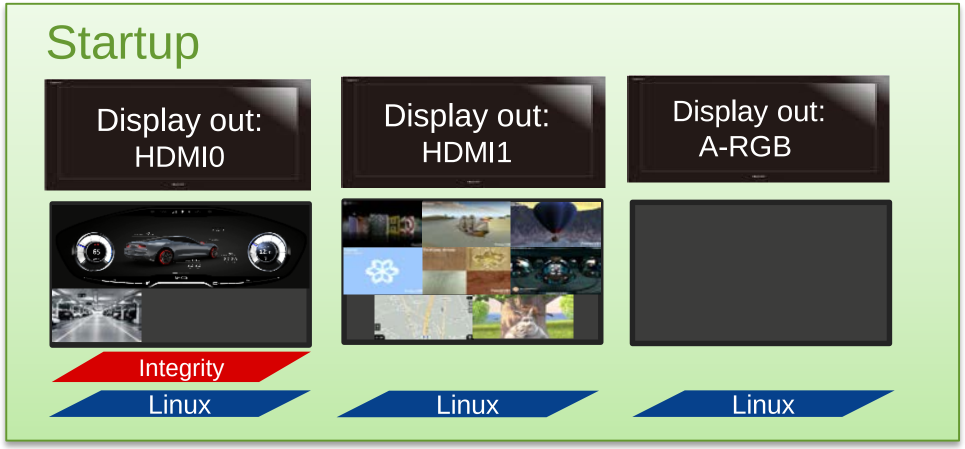
Display and GPU Sharing in Canvas Demo

- Overview
- Video demonstrations
  - Video 1: showing gfx interaction
  - Video 2: focus on gfx sharing into cluster
- Enabling technology
  - Major building blocks
  - Some benefits of the approach

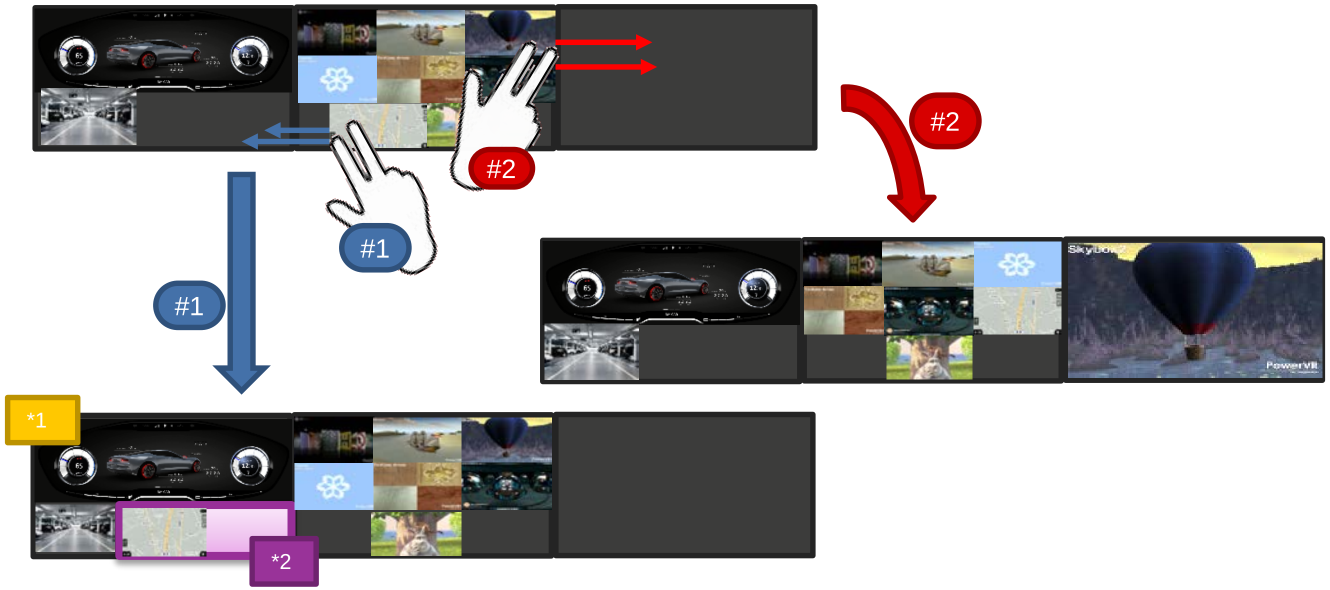
Canvas Demo Overview

- Created to demonstrate consolidation of cockpit onto single H3 SoC running on single Salvator-X board
- Various variants created, combining cluster/adas/ivi, but today showing you Linux gfx sharing into cluster running Integrity
- Demo has three Displays
  - Integrity and Linux share display 1. Display 2 and 3 dedicated to Linux.
- Touch gestures allows Linux apps to be swiped and scaled on screen

Canvas Demo Overview



*1:Make the cluster partially transparent in order to see the Linux graphics.



*2:When Linux app windows are swiped to the display shared with Integrity apps they are put in this space.

Enabling Technology

- H/W (Renesas R-Car H3)
  - GPU Virtualisation
    - IPMMU and GPU Multiple Input Ports, OS ID and GPU Scheduler provides OS guest separation and protection
    - Each OS “sees” its own GPU
  - Display compositor layers with per pixel alpha blending (VSPD IP)
    - Each OS has its own dedicated layer to draw into
    - Compositing them so Linux is behind the Cluster in Z-ordering protects the Cluster from being overwritten
    - Per pixel alpha allows flexible combination of the layers
  - Image/video processing and transformation (various IP)
    - Provides smooth application window transformation
- Green Hills Integrity RTOS and Multivisor Hypervisor (HV)
  - Further strengthens guest separation and protection
  - Cluster Safety OS
  - Display Manager provides Display Sharing for display 0
    - Describes display and GPU each OS sees

Positives

- Linux/Android does not need to know about cluster or concern itself about maintaining a high cluster fps
- Safety OS gains protection from being drawn over by Linux, whilst its performance (fps) is maintained
- If HV already present, no extra protocols to invent to get gfx/interaction etc, from Linux to “other OS” and back. Native apps just do their thing.
- HV Display Sharing can provide flexibility on display size and position for each OS, which can be enhanced further by H/W compositor layer alpha blending.
  - E.g. Present window between cluster dials to Linux for it to draw maps, multimedia.

- But like all tech it of course is not a silver bullet for all use cases...
  - Inter-ECU vs consolidated ECU. Display Sharing vs Surface Sharing.
  - Lucky we have a day to discuss tomorrow!

Thank you!

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