HWComposer in Weston

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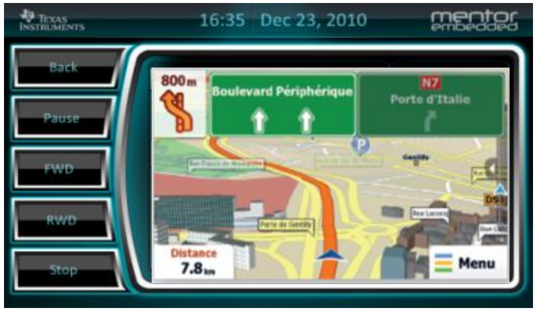
Outline

- Automotive Use Cases
- Graphics Stack – Linux vs Android
- HWComposer
  - Overview
  - Composition Policies
- Discussion Topics
- Reference

Automotive Use cases

Cars of Today / Tomorrow



Feature Sets

- ADAS
- Center Console
- Digital Instrument Cluster
- Heads Up Display
- Navigation
- Media Player
- Augmented Reality
- Connectivity
- Early Video – Rear View Camera

Graphics Requirements

✓Window System => 10-12 layers per app

✓Multiple displays => 2-3

✓Streaming Video textures

✓Efficient GFX buffer management

✓DRM master “workaround”

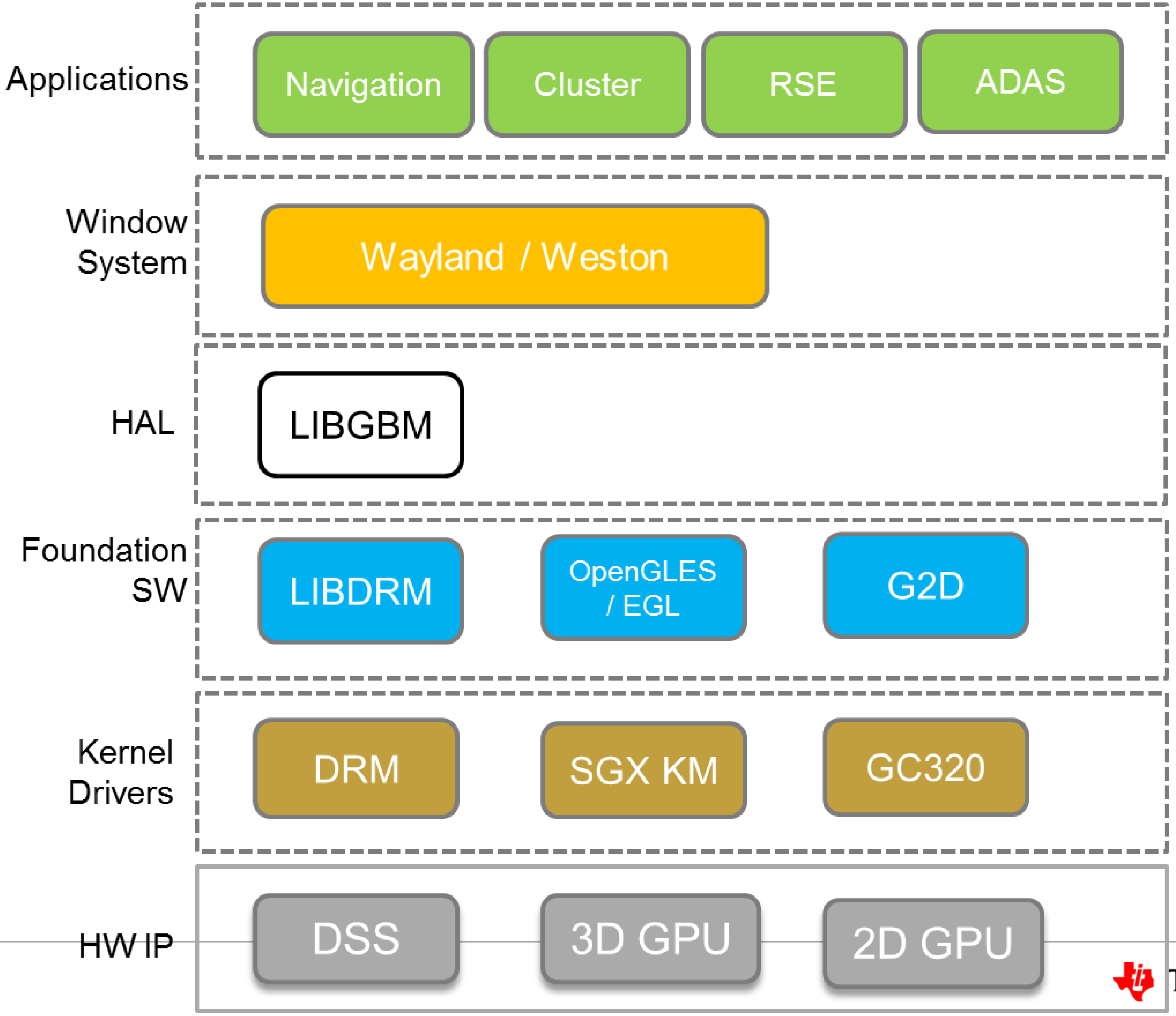
✓Compute => OpenCL / GPGPU

×Efficient Composition

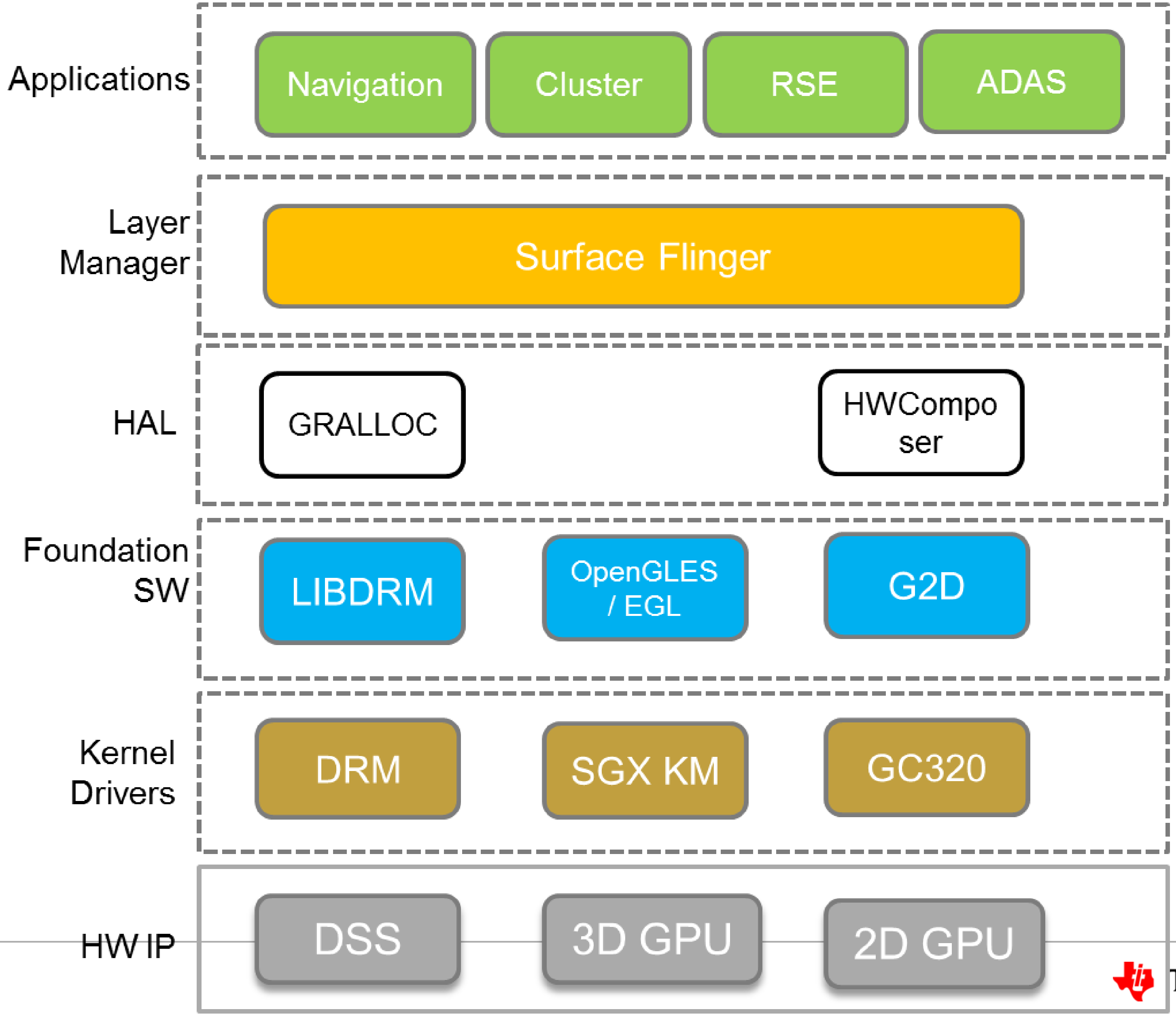
✓OpenGLES 2.0 +

Graphics Stacks

Linux Graphics Stack



Android Graphics Stack

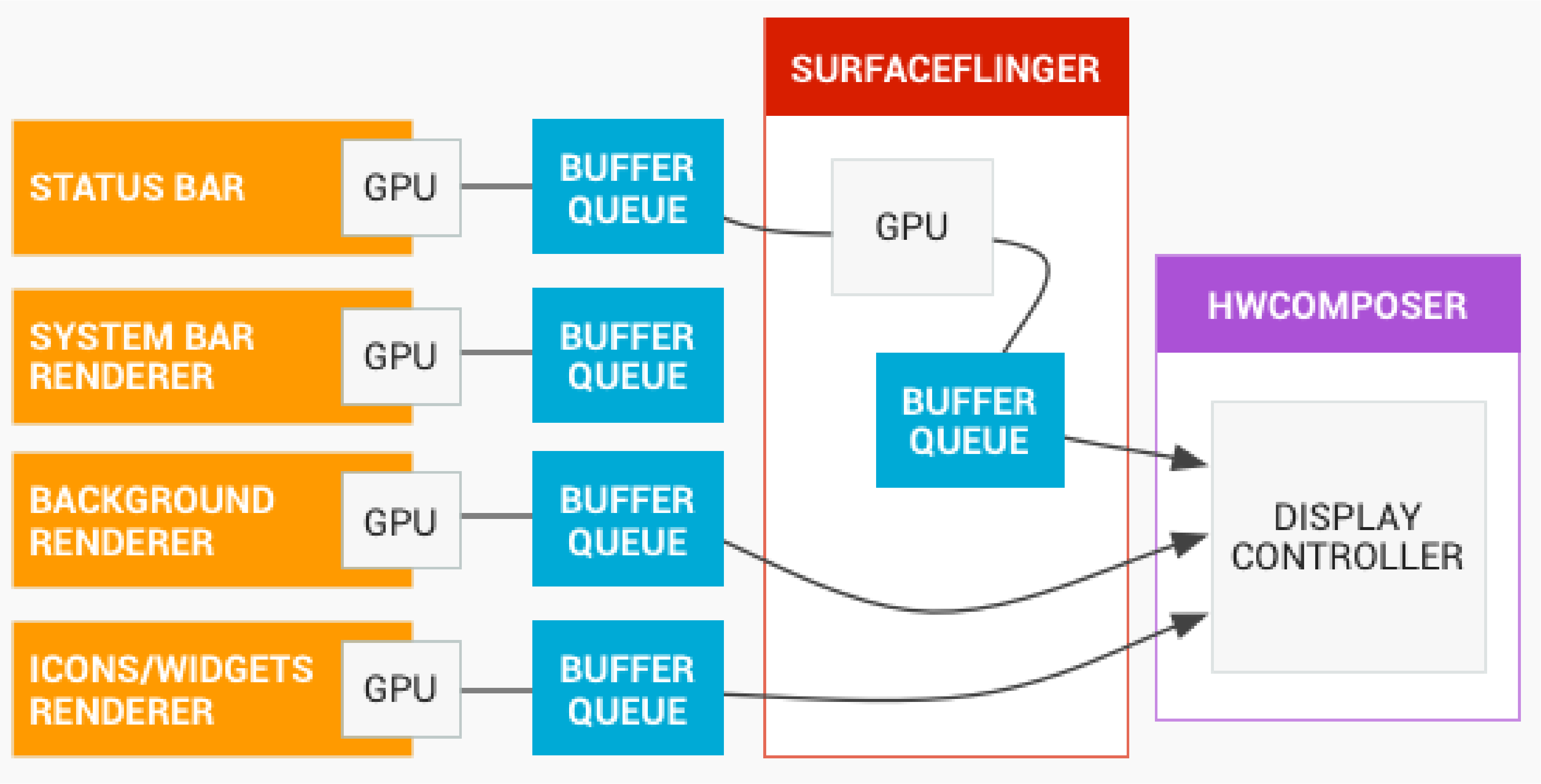


Status Quo

- Good convergence at lower layers of Graphics stack
- Android
  - Switched to KMS for modesetting
  - GRALLOC still the interface but internally uses GEM instead of ION
  - HWComposer uses GRALLOC flags
- Linux
  - Weston integrates well with OpenGLES / DRM for embedded SoCs
  - No well defined interface for HW composition in Weston (by design)

HWComposer

Android Composition



Source - http://source.android.com/devices/graphics/images/graphics_pipeline.png

HWComposer Overview

- Clean, well-documented Interface
- https://github.com/android/platform_hardware_libhardware/blob/master/include/hardware/hwcomposer.h

- Two main APIs
  - prepare
    - Identify which layers can be composited by HW
    - Rest of layers go through OpenGLES composition
    - Hints to specify behavior
  - set
    - Trigger composition of selected layers in HW
    - Display to screen

HWComposer Policies

- Decide based on DDR bandwidth, power, GPU offload
- Policy considerations
  - Pixel format is important – YUV => DSS better for most modern HW
  - Small layers => 2D GPU / blitter
  - Layer frame rate - Higher FPS => DSS
  - Layer size – Higher => DSS
  - Z-Order – Lower => 3D GPU (HSR beneficial)
  - Transparency – Per pixel Alpha => DSS

Discussion Topics

Areas

- New compositor backend implementation
  - compositor-hwcomposer.c
- Sync between OpenGLES composition and HW composition
  - Explicit vs Implicit sync?
- Modeset nodes
  - Multiple masters – one per CRTC?
- Graphics Buffer Management
  - GRALLOC vs GBM
  - Not a major concern – can be handled inside HWcomposer
- Relevant product space / Industry interest
  - Anyone with stakes in both Linux and Android?
  - With sufficient interest, can engage Linaro

Reference

- http://source.android.com/devices/graphics/architecture.html
- http://source.android.com/devices/graphics/
- http://wayland.freedesktop.org/
- http://www.ti.com/ww/en/analog/car-of-the-future/

Questions?