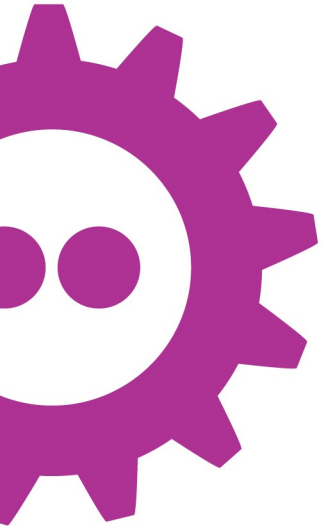
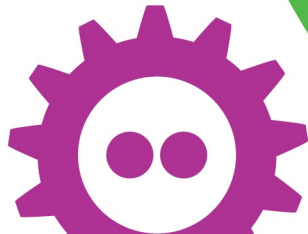




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Running Android on the Mainline Graphics Stack



Robert Foss
@memcpy_io

FOSDEM¹⁸

Agenda

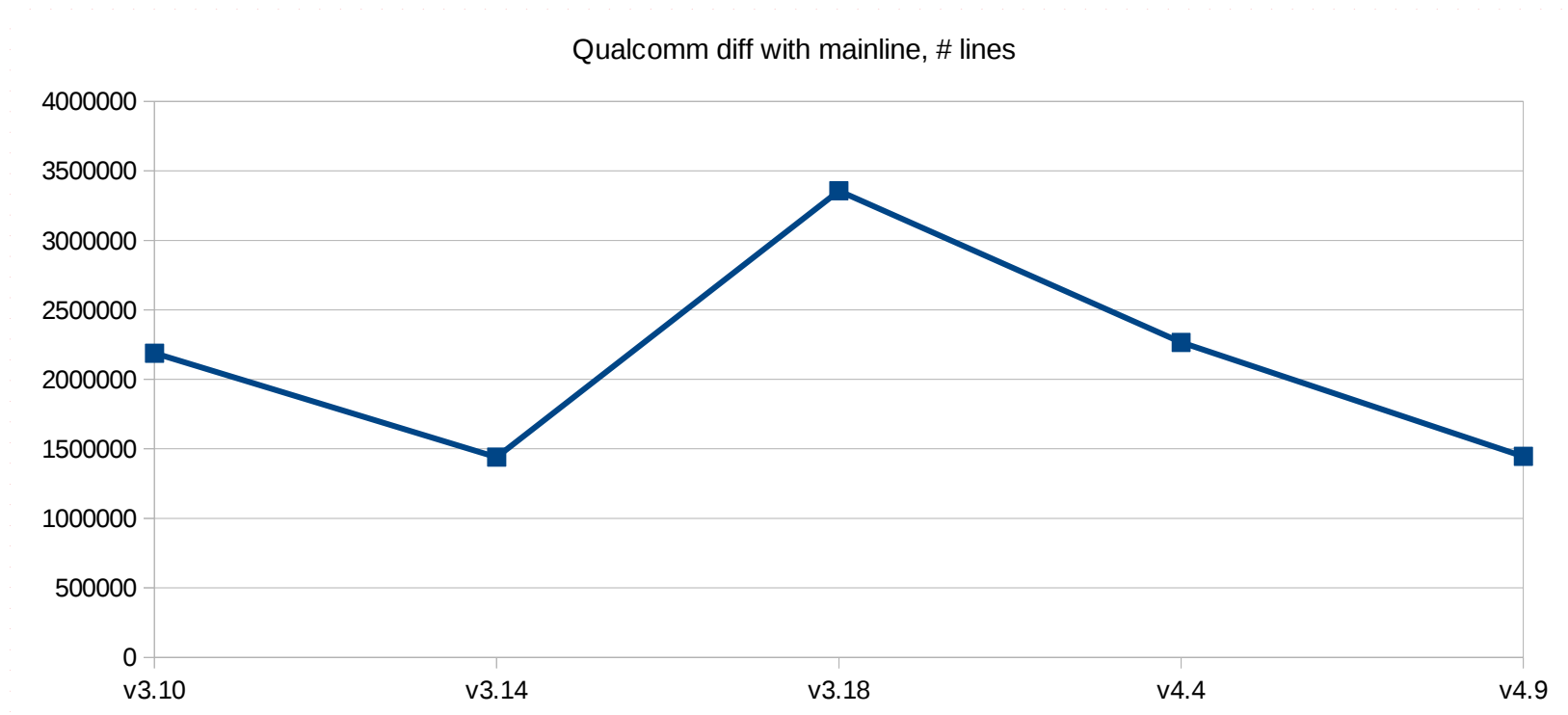
- Android History
- Android on Mainline
- Current Status
- Big Picture

Android History



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Android History





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Android History

- Android forked the Kernel



Android History

- Android forked the Kernel
 - Better Graphics stack was needed



Android History

- Android forked the Kernel
 - Better Graphics stack was needed
 - Support for low power was lacking



Android History

- Android forked the Kernel
 - Better Graphics stack was needed
 - Support for low power was lacking
 - Support for atomic operations



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Android History

- Android forked the Kernel
- Android Atomic Display Framework created



Android History

- Android forked the Kernel
- Android Atomic Display Framework created
 - Not extensible or generic



Android History

- Android forked the Kernel
- Android Atomic Display Framework created
 - Not extensible or generic
 - Only atomic for plane updates



Android History

- Android forked the Kernel
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 - Only atomic for plane updates
 - Not compatible with current ABI



Android History

- Android forked the Kernel
- Android Atomic Display Framework created
 - Not extensible or generic
 - Only atomic for plane updates
 - Not compatible with current ABI
 - Not upstreamable



Android History

- Android forked the Kernel
- Android Atomic Display Framework created
- Mainline Atomic KMS ABI introduced



Android History

- Android forked the Kernel
- Android Atomic Display Framework created
- Mainline Atomic KMS ABI introduced
 - Supports the ADF usecases



Android History

- Android forked the Kernel
- Android Atomic Display Framework created
- Mainline Atomic KMS ABI introduced
 - Supports the ADF usecases
 - Uses Properties to be generic



Android History

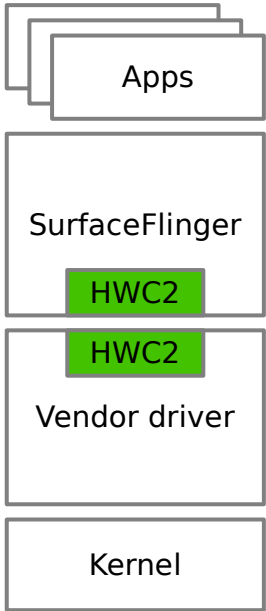
- Android forked the Kernel
- Android Atomic Display Framework created
- Mainline Atomic KMS ABI introduced
 - Supports the ADF usecases
 - Uses Properties to be generic
 - Is now replacing ADF in vendor drivers

Android on Mainline



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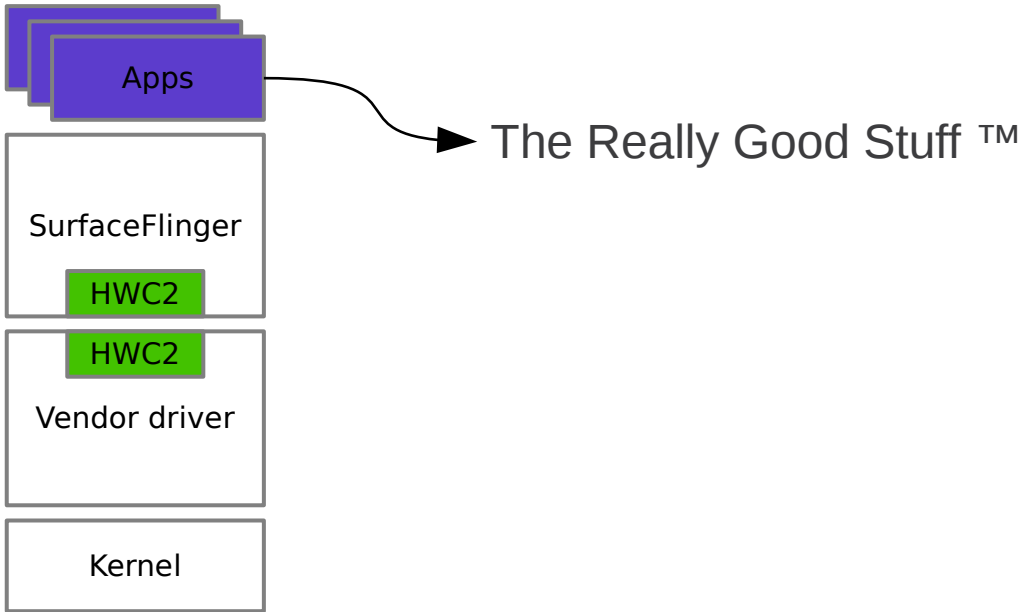
Android Graphics Stack





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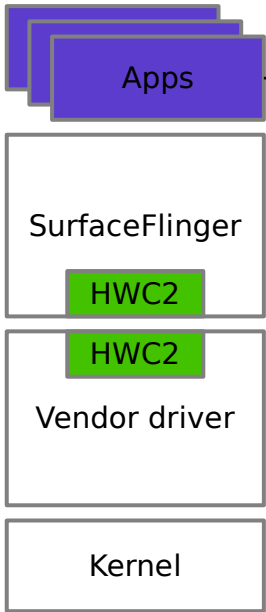
Android Graphics Stack





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Android Graphics Stack

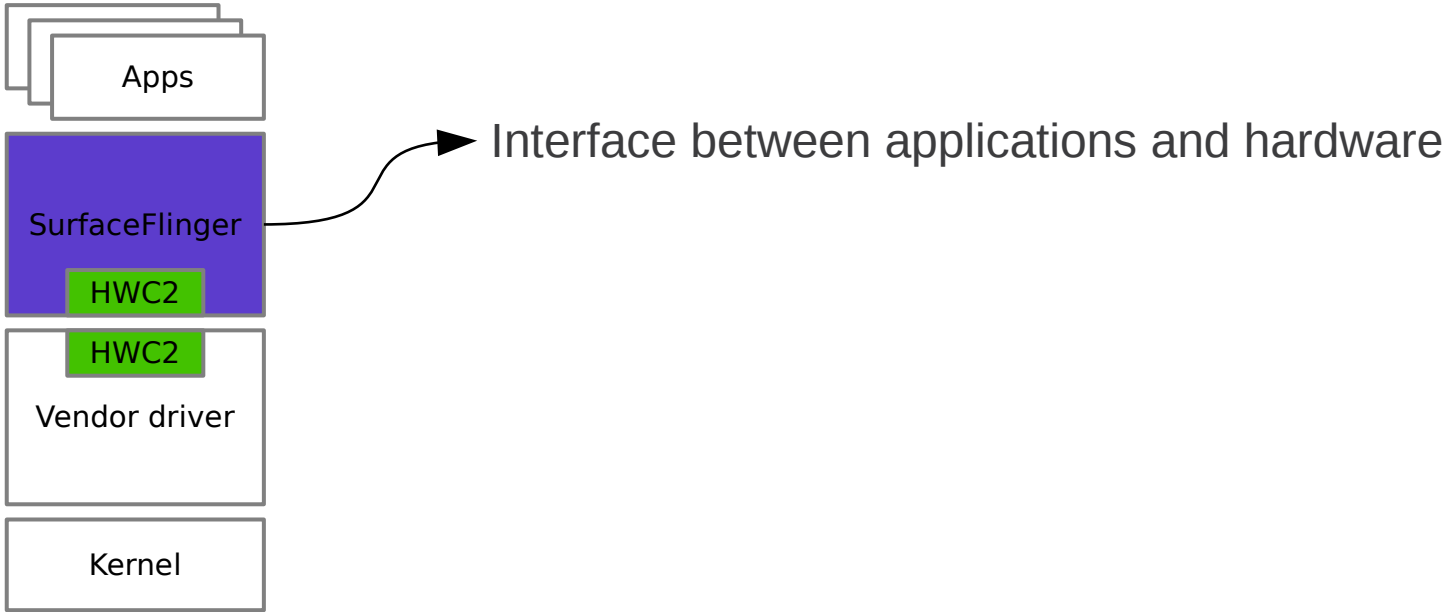


The Really Good Stuff™
- No really, this is the whole point!



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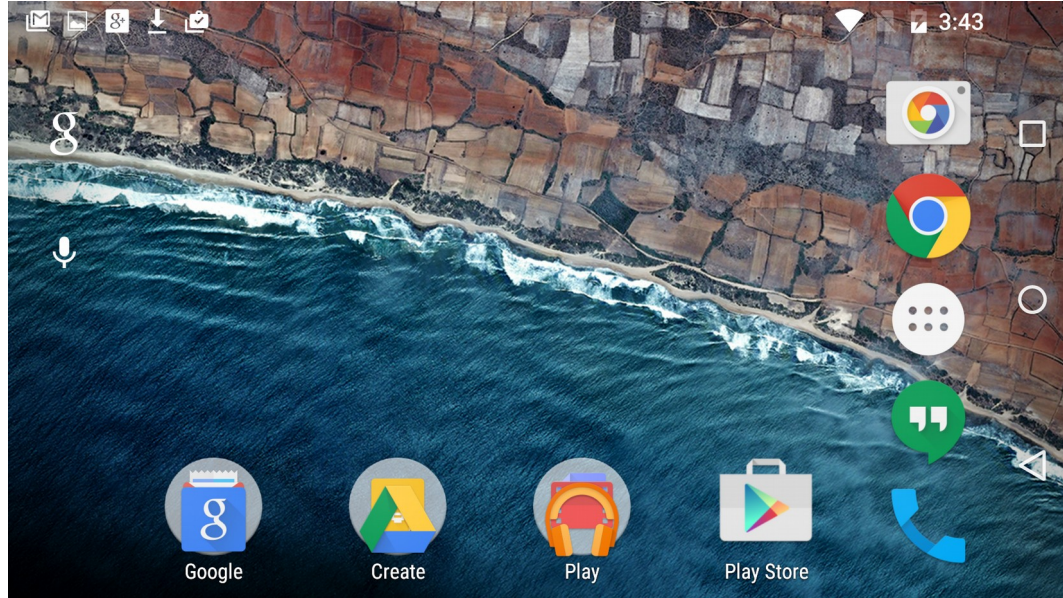
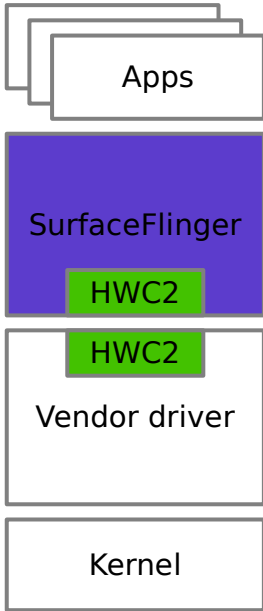
Android Graphics Stack





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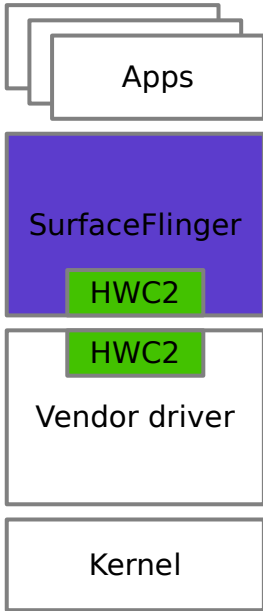
Android Graphics Stack



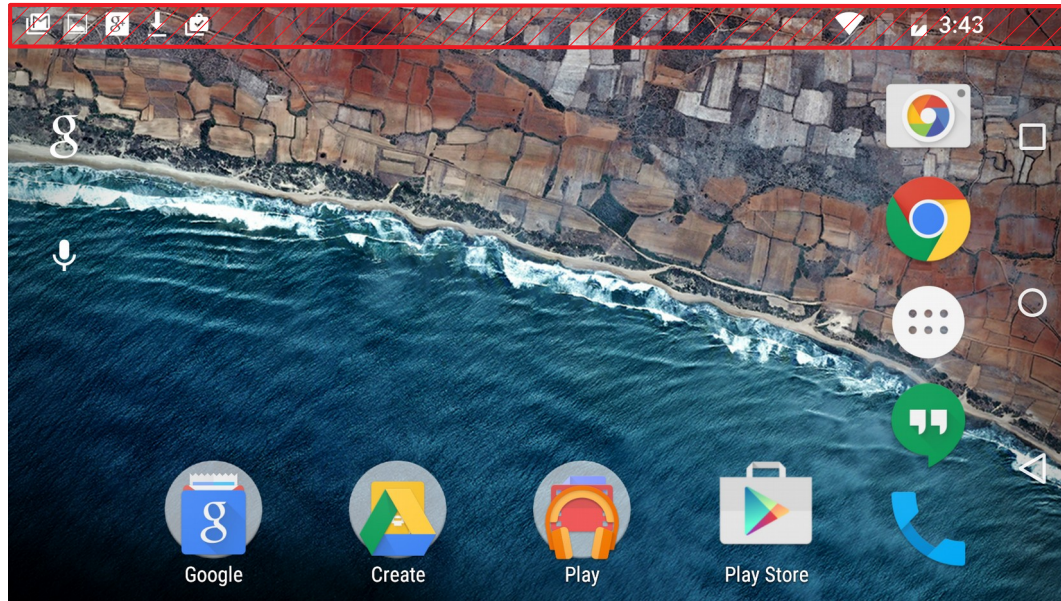


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Android Graphics Stack



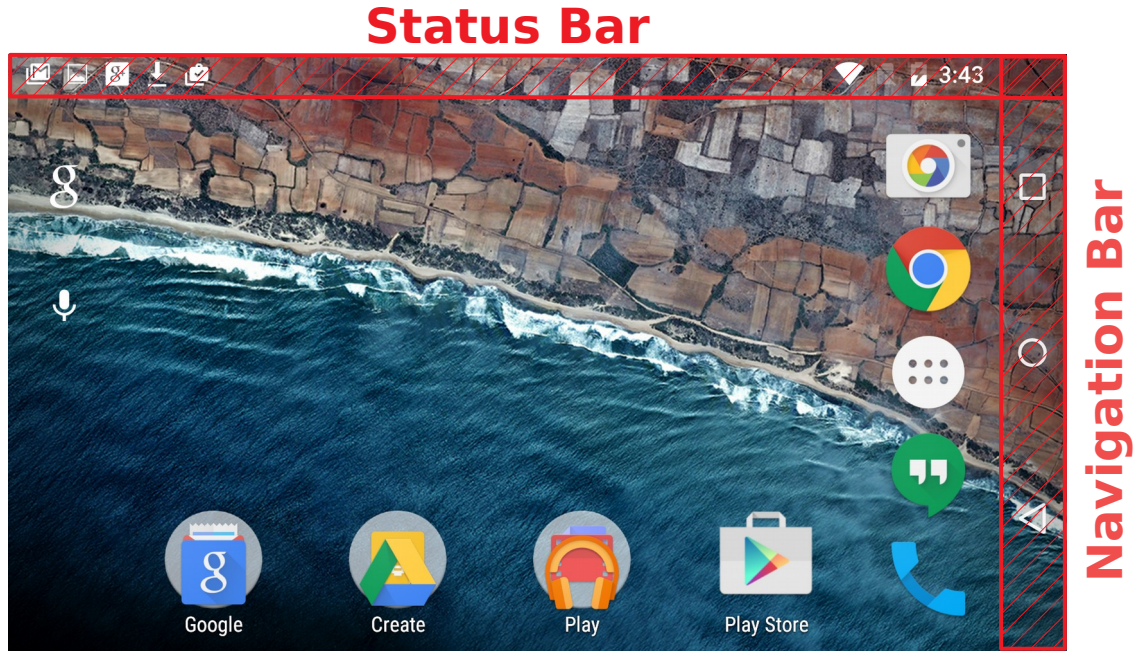
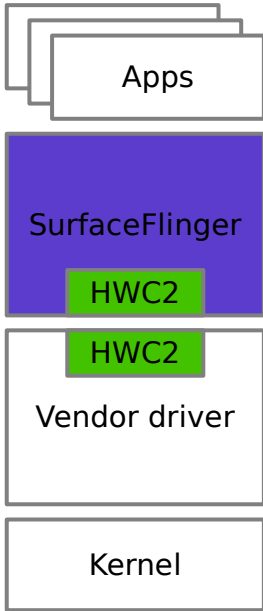
Status Bar





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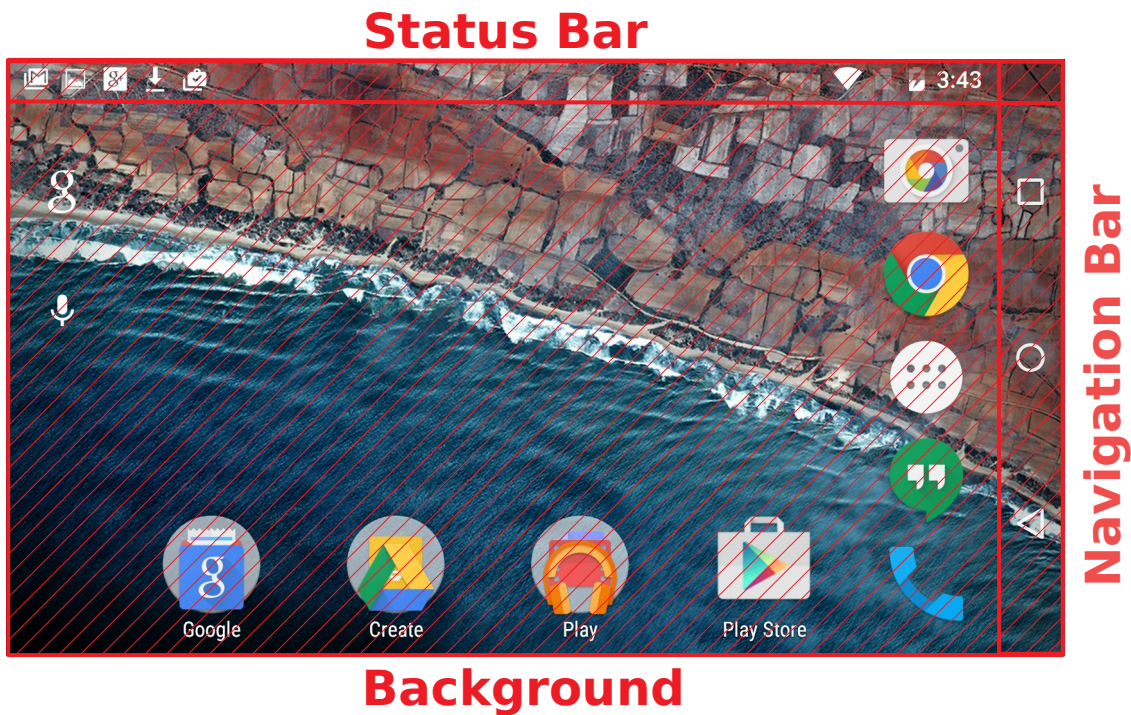
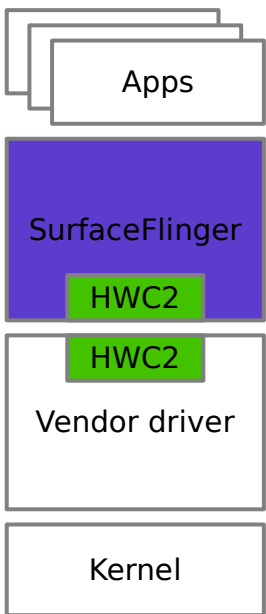
Android Graphics Stack





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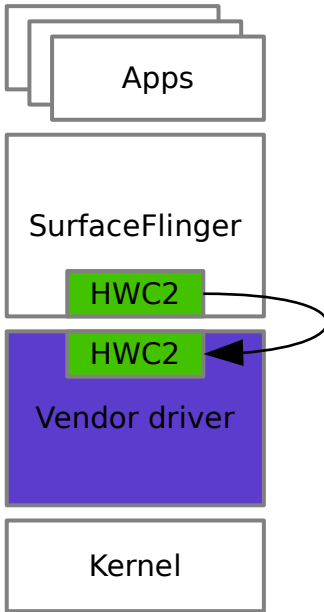
Android Graphics Stack





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Android Graphics Stack



SurfaceFlinger speaks HWC to the Composer



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Android Graphics Stack

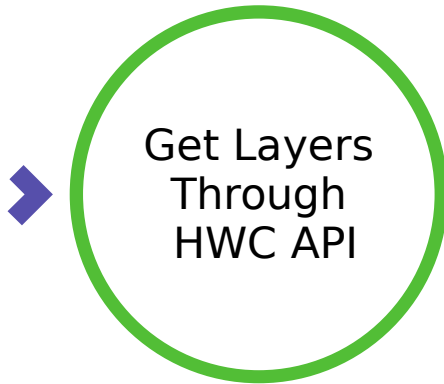
What does the Hardware Composer do?



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Android Graphics Stack

What does the Hardware Composer do?

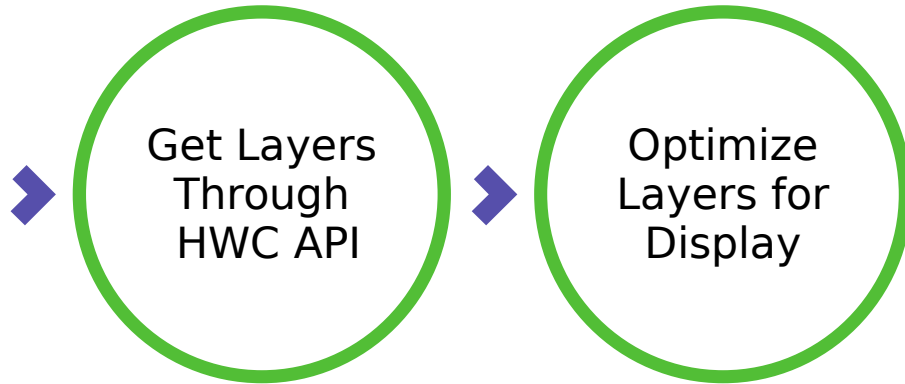




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Android Graphics Stack

What does the Hardware Composer do?

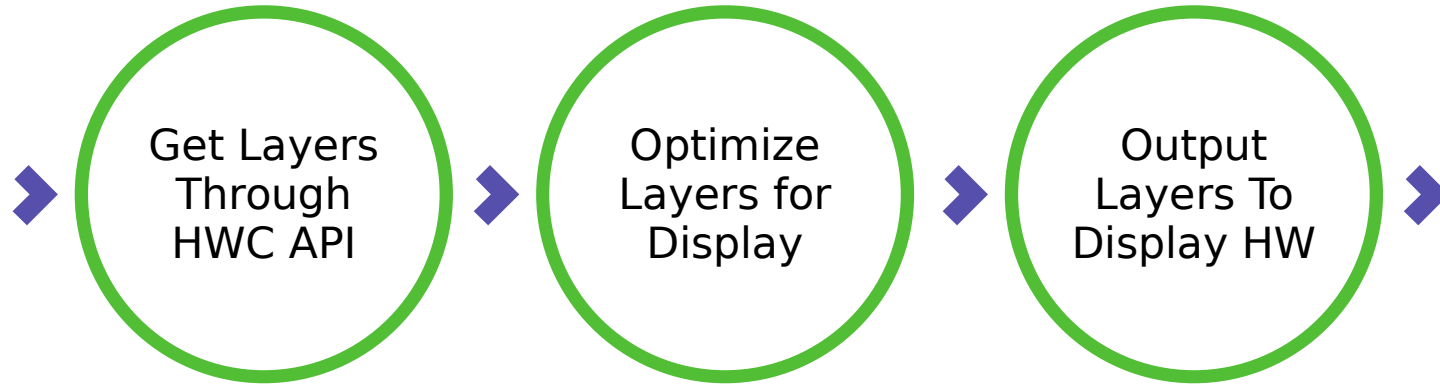




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Android Graphics Stack

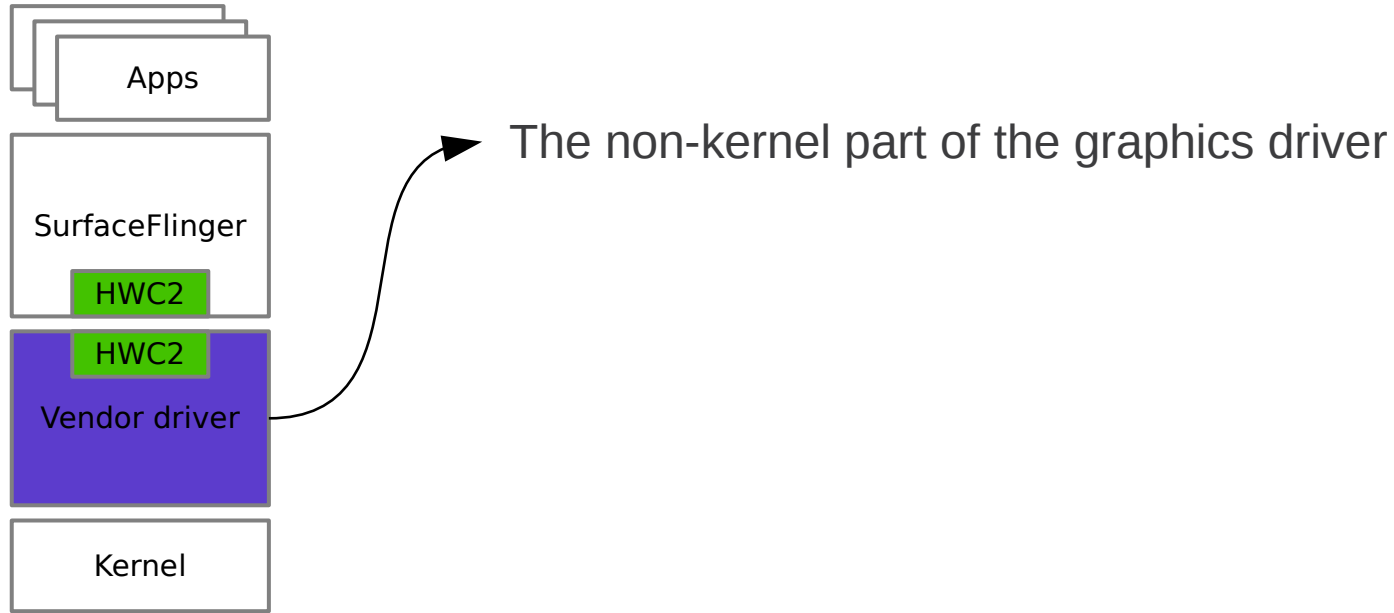
What does the Hardware Composer do?





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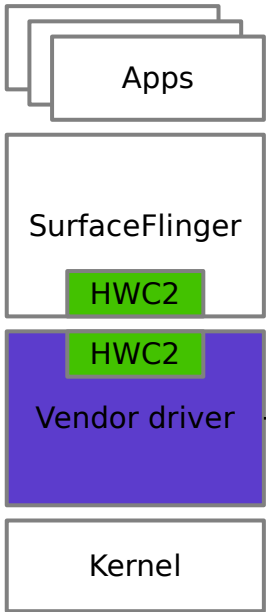
Android Graphics Stack





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Android Graphics Stack

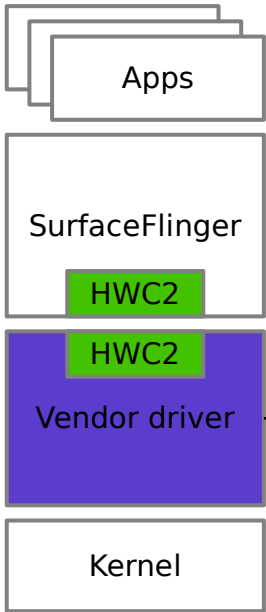


The non-kernel part of the graphics driver
- OpenGL, Vulkan, memory allocator, etc.



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Android Graphics Stack



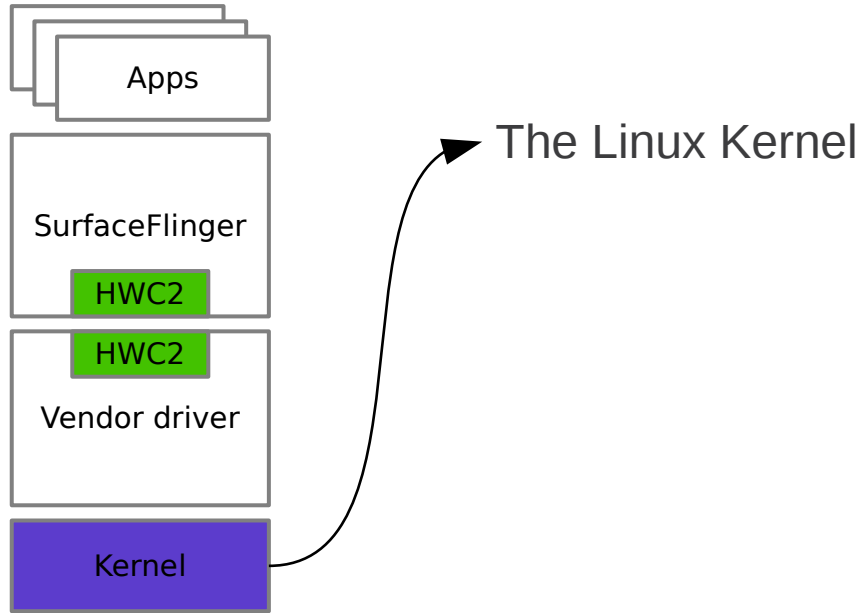
The non-kernel part of the graphics driver

- OpenGL, Vulkan, memory allocator, etc.
- Hardware Composer



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Android Graphics Stack





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Mainline Graphics Stack

- Mainline now has good Graphics ABI



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Mainline Graphics Stack

- Mainline now has good Graphics ABI
- Google Pixel C shipped using Atomic KMS



Mainline Graphics Stack

- Mainline now has good Graphics ABI
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Mainline Graphics Stack

- Mainline now has good Graphics ABI
- Google Pixel C shipped using Atomic KMS
 - Android requires HWC implementation
 - Mesa and the Kernel does not implement it



Mainline Graphics Stack

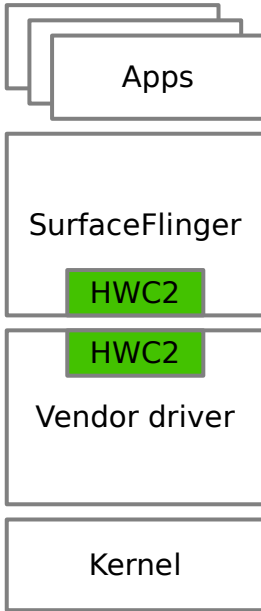
- Mainline now has good Graphics ABI
- Google Pixel C shipped using Atomic KMS
 - Android requires HWC implementation
 - Mesa and the Kernel does not implement it
 - `drm_hwcomposer` does!



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Mainline Graphics Stack

What is the Hardware Composer?

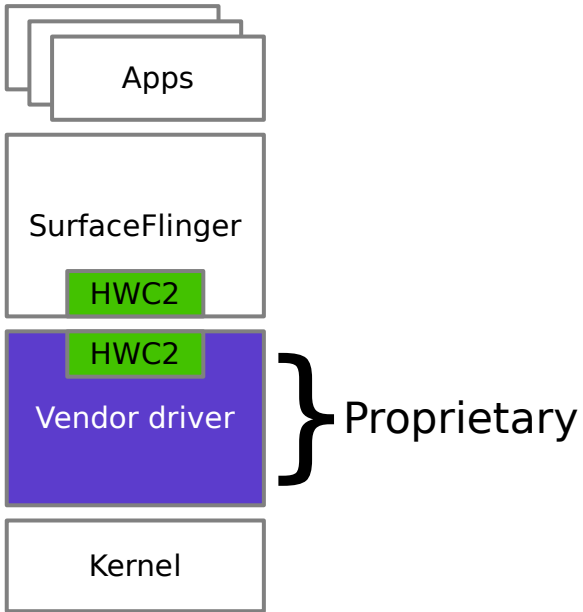




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Mainline Graphics Stack

What is the Hardware Composer?

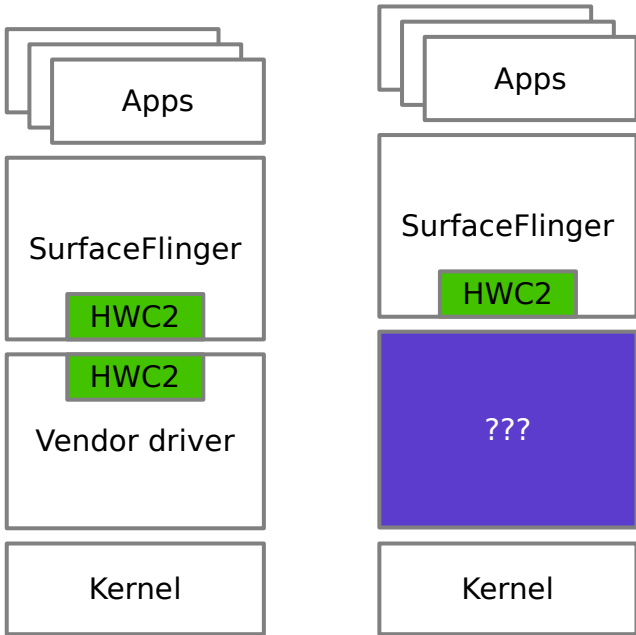




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Mainline Graphics Stack

What is the Hardware Composer?

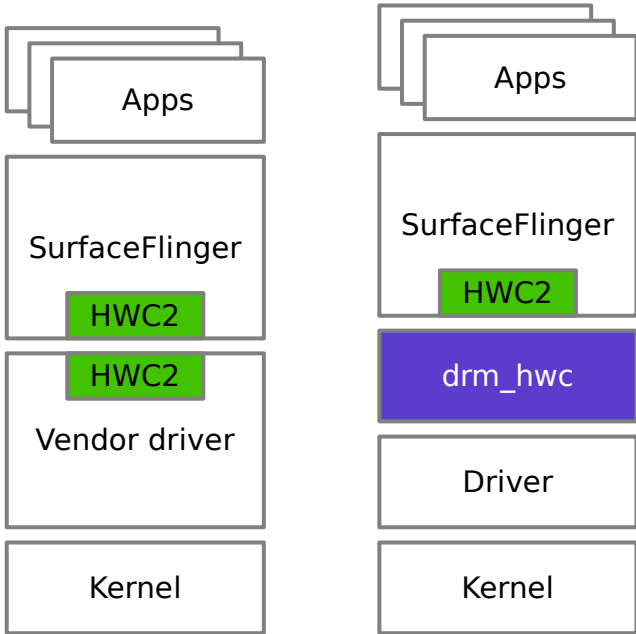




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Mainline Graphics Stack

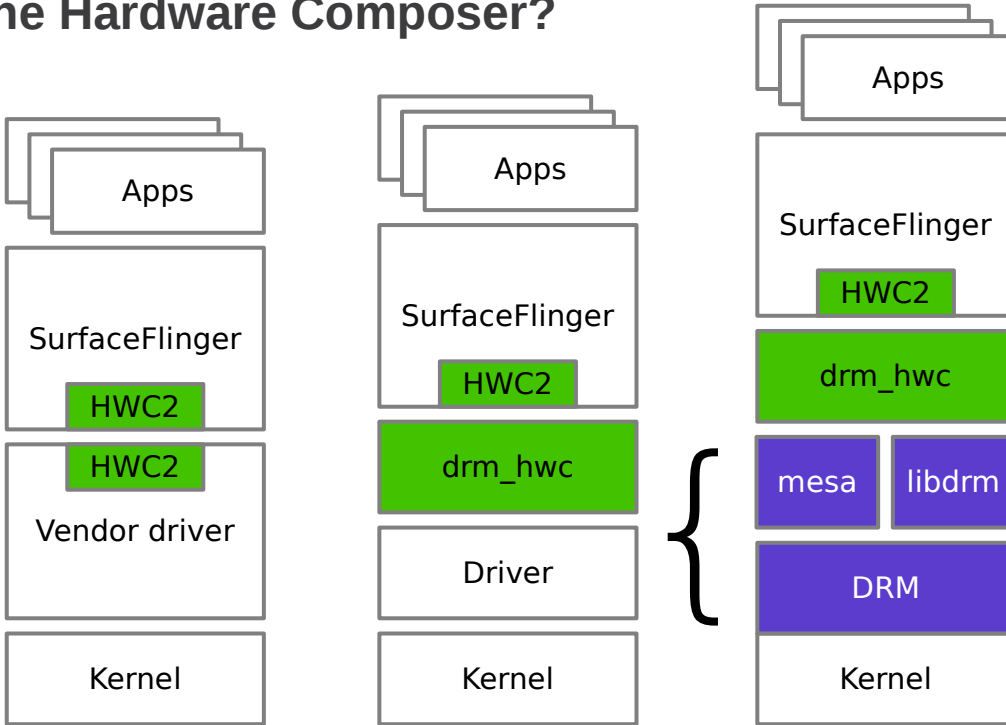
What is the Hardware Composer?





Mainline Graphics Stack

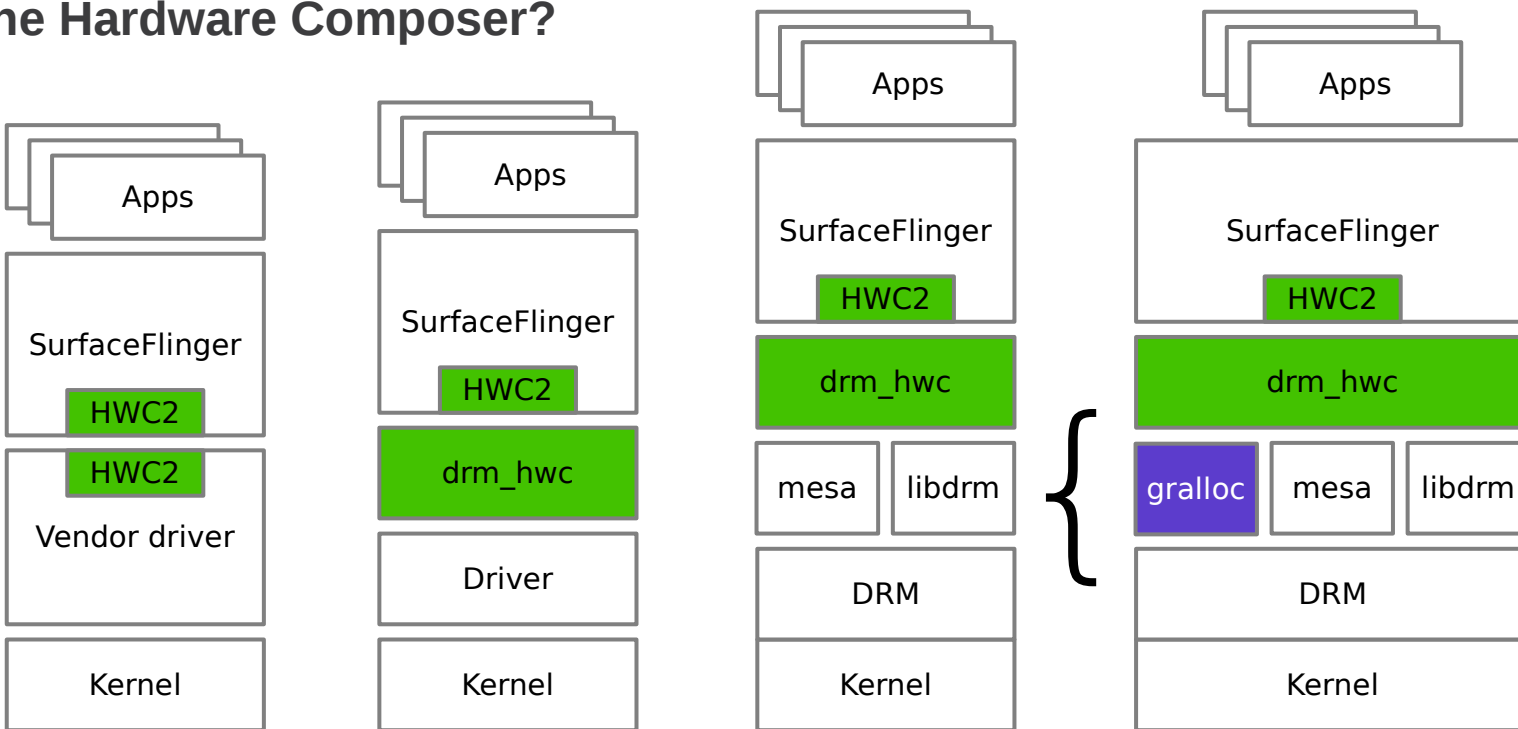
What is the Hardware Composer?





Mainline Graphics Stack

What is the Hardware Composer?



drm_hwcomposer

HWC2



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drm_hwcomposer

HWC2

- Android added buffer Fence support



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drm_hwcomposer

HWC2

- Android added buffer Fence support
 - Ensures ordering between operations



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drm_hwcomposer

HWC2

- Android added buffer Fence support
 - Ensures ordering between operations
 - Synchronizes buffer sharing



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drm_hwcomposer

HWC2

- Android added buffer Fence support
- HWC version 2 is improved using Fences



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drm_hwcomposer

HWC2

- Android added buffer Fence support
- HWC version 2 is improved using Fences
- Mainline received Fence support



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drm_hwcomposer

HWC2

- Android added buffer Fence support
- HWC version 2 is improved using Fences
- Mainline received Fence support
- drm_hwcomposer implemented HWC2



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drm_hwcomposer

Project Hosting

- Previously hosted within ChromiumOS



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drm_hwcomposer

Project Hosting

- Previously hosted within ChromiumOS
- Now hosted on [Freedesktop.org](https://freedesktop.org)



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drm_hwcomposer

Project Hosting

- Previously hosted within ChromiumOS
- Now hosted on [Freedesktop.org](https://freedesktop.org)
 - Thanks Google:
 - Sean Paul
 - Puneet Kumar
 - Marissa Wall



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drm_hwcomposer

Project Hosting

- Previously hosted within ChromiumOS
- Now hosted on Freedesktop.org
- GitLab instance on Freedesktop.org soon!

Current Status

Current status

Tested platforms

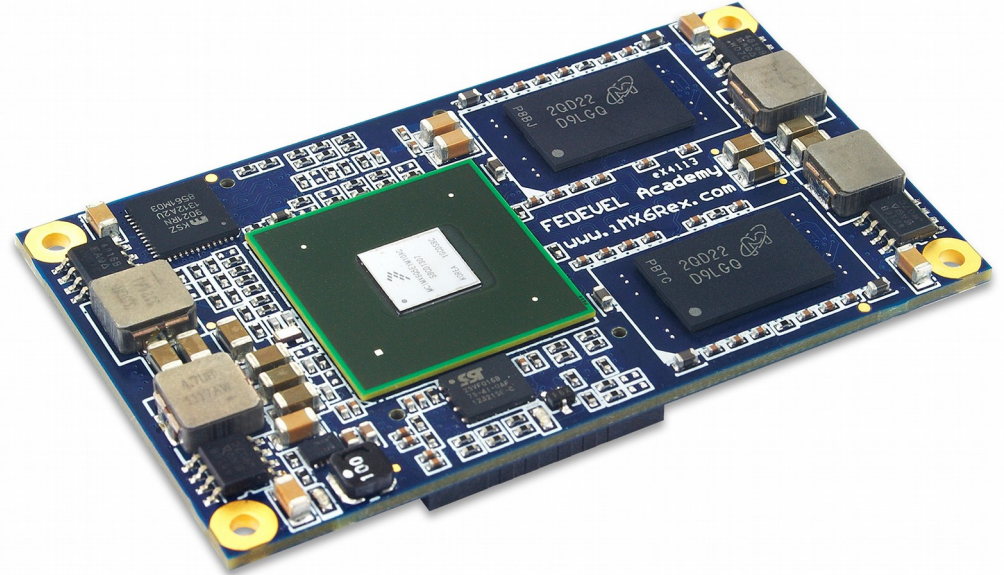


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Current status

Tested platforms

- iMX6
 - GPU: Vivante GC3000



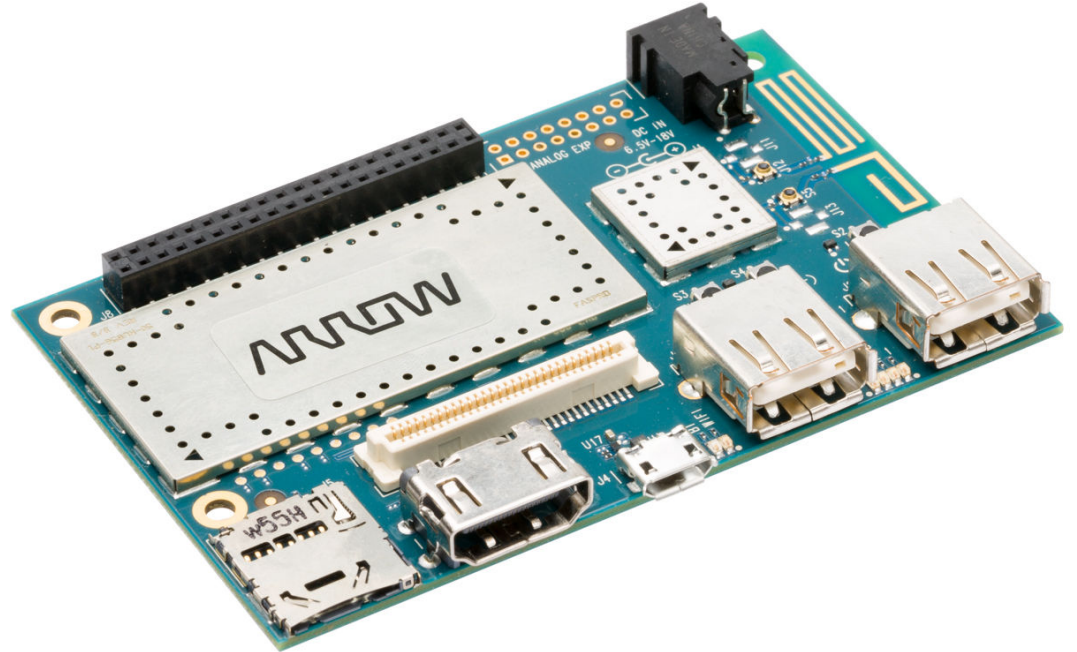


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Current status

Tested platforms

- Dragonboard 410c
 - GPU: Adreno 306



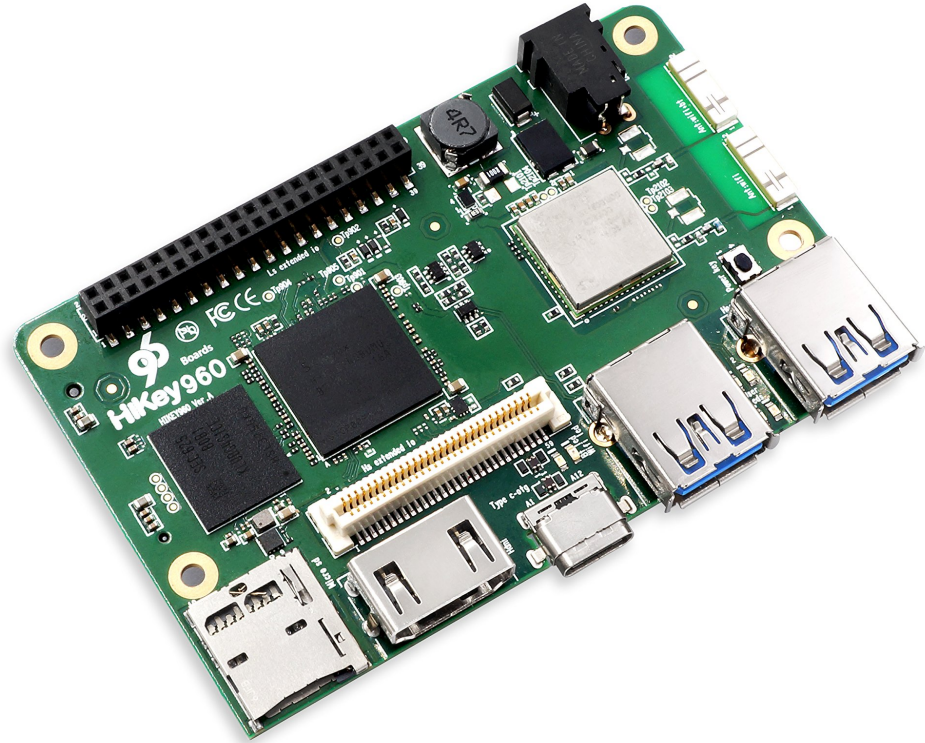


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Current status

Under Development

- HiKey 960
 - GPU: Mali G71





Big Picture



Big Picture

Merge Android Features



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Big Picture

Merge Android Features

- A new feature is introduced in Android



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Big Picture

Merge Android Features

- A new feature is introduced in Android
- Slowly migrated into the kernel



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Big Picture

Merge Android Features

- A new feature is introduced in Android
- Slowly migrated into the kernel
- This does not to apply to all subsystems

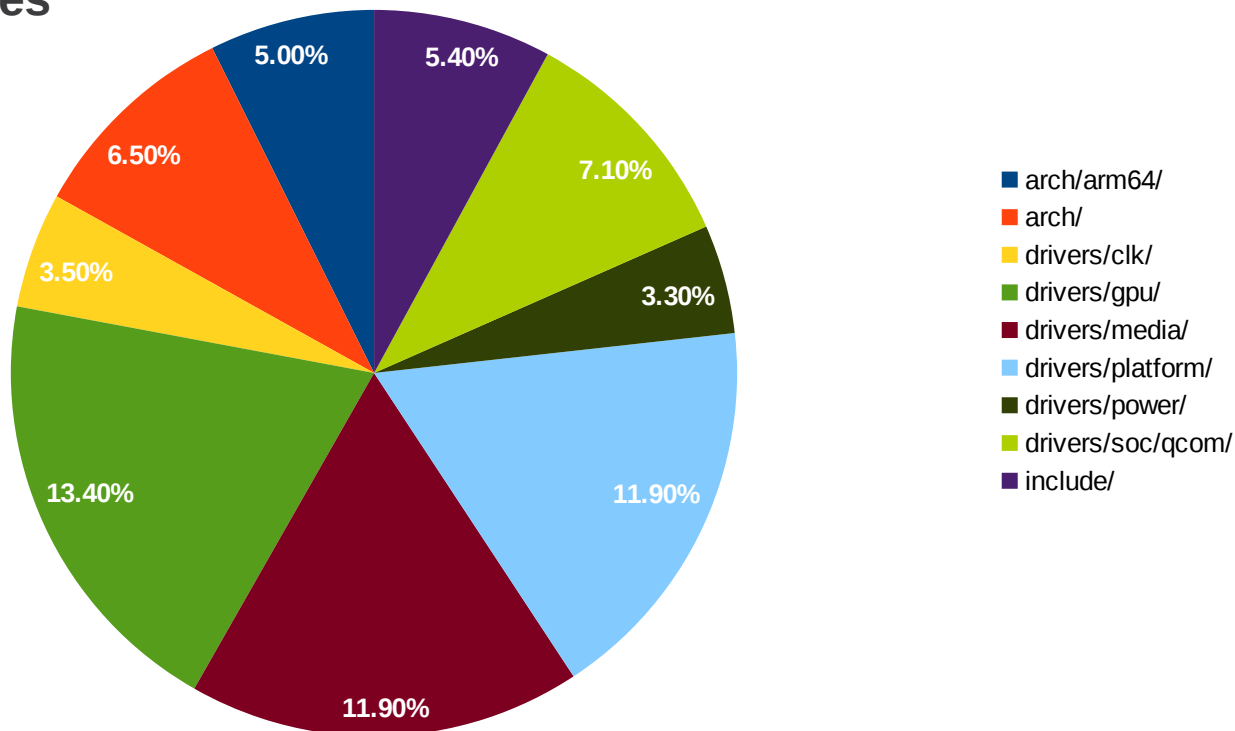


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Big Picture

Merge Android Features

Qualcomm v4.9 Diff





Big Picture

Merge Android Features

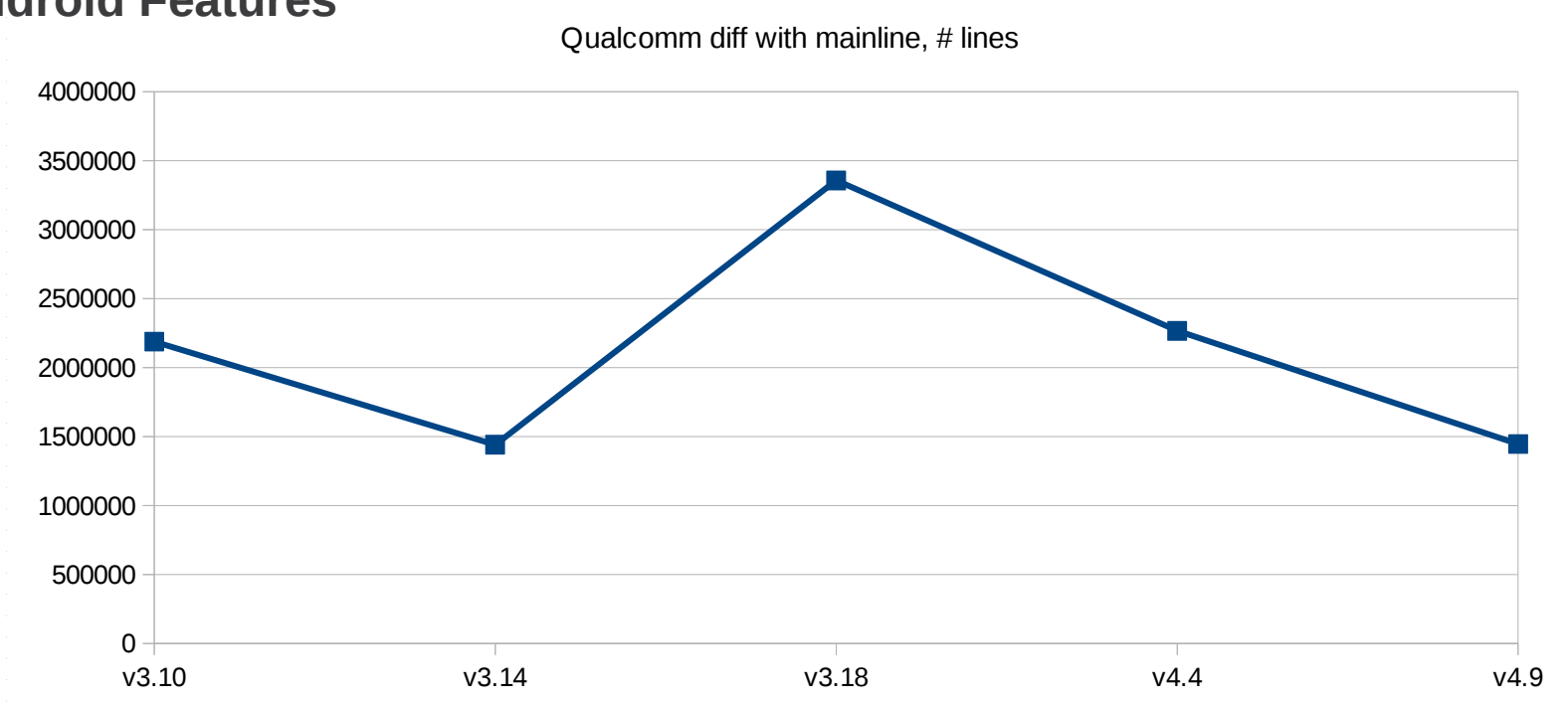
- A new feature is introduced in Android
- Slowly migrated into the kernel
- This does not to apply to all subsystems
- The diff for drivers seem fairly constant



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Big Picture

Merge Android Features





Big Picture

Push industry towards Open Source



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Big Picture

Push industry towards Open Source

- Increase device development speed



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Big Picture

Push industry towards Open Source

- Increase device development speed
- Lower driver development costs



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Big Picture

Push industry towards Open Source

- Increase device development speed
- Lower driver development costs
- Increase driver quality



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Big Picture

Push industry towards Open Source

- Increase device development speed
- Lower driver development costs
- Increase driver quality
- Push Open Source adoption forward



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Running Android on the Mainline Graphics Stack

Any questions?

