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# Running Android on the Mainline Graphics Stack

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[@memcpy\\_io](#)

Open First

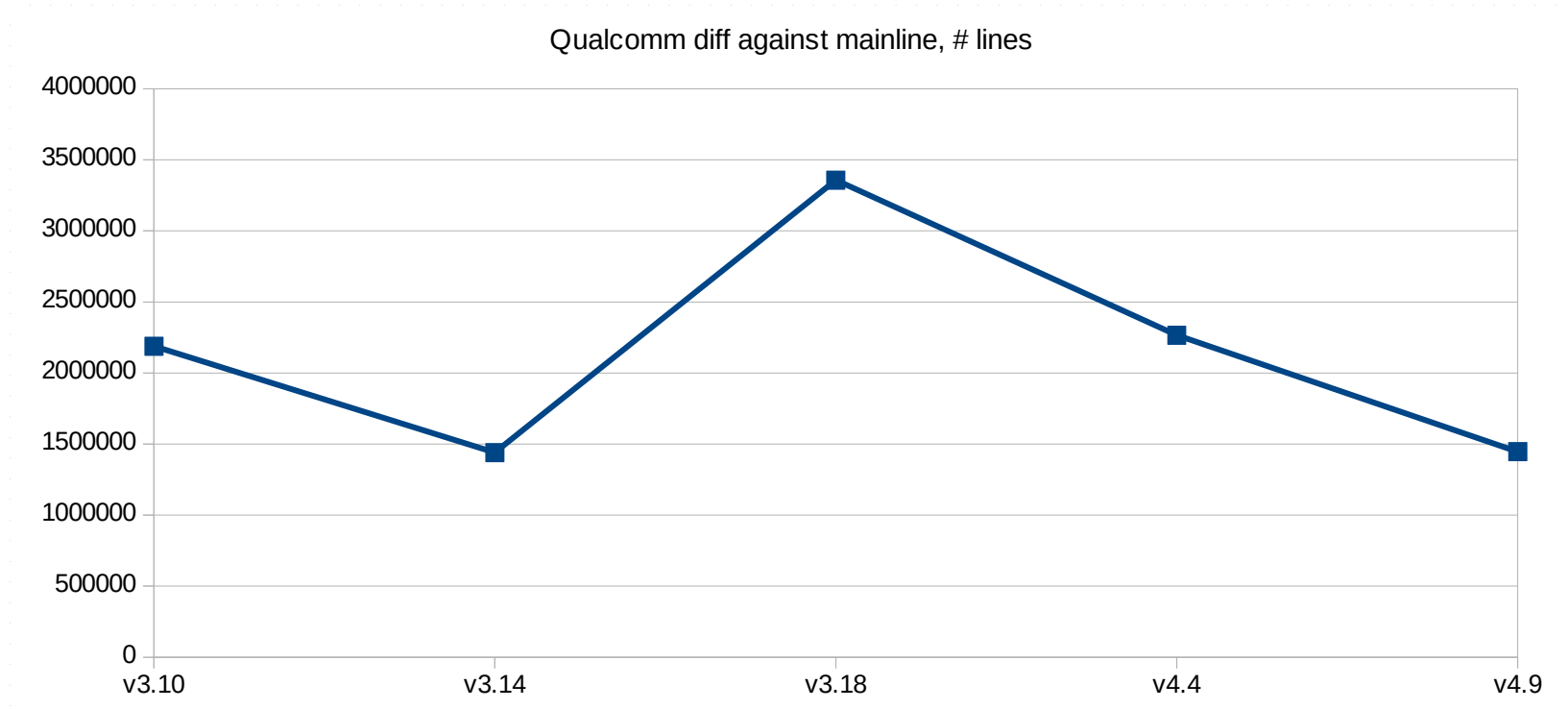
# Agenda

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

# Android History



# Android History





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# Android History

- Android forked the Kernel



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  - Better Graphics stack was needed

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  - Support for low power was lacking
  - Support for atomic operations missing





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# Android History

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- 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

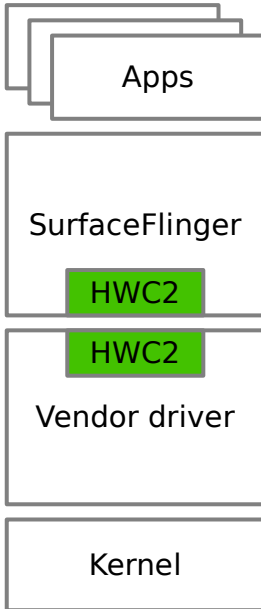


# Android on Mainline



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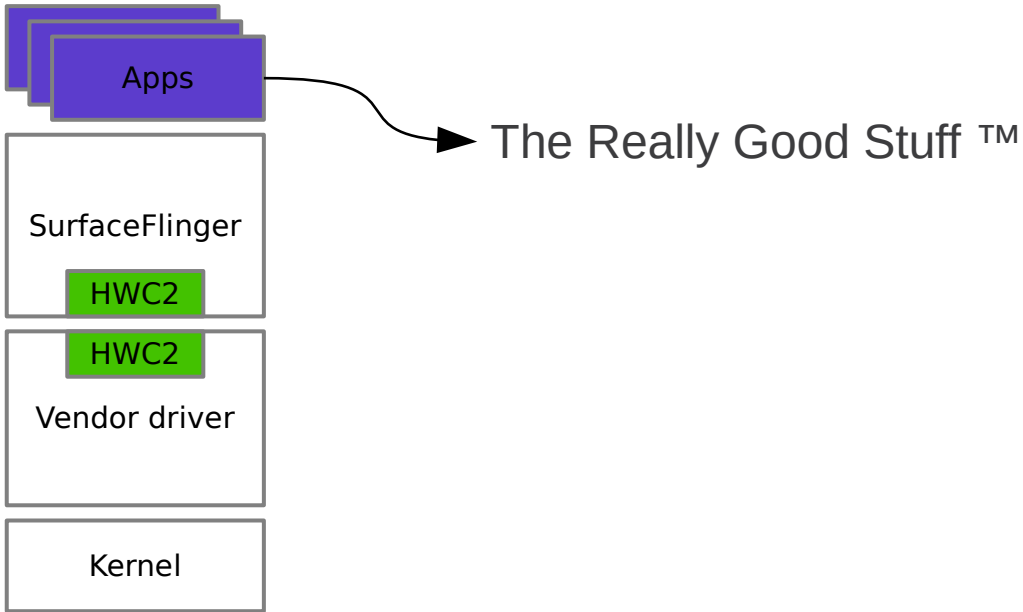
# Android Graphics Stack





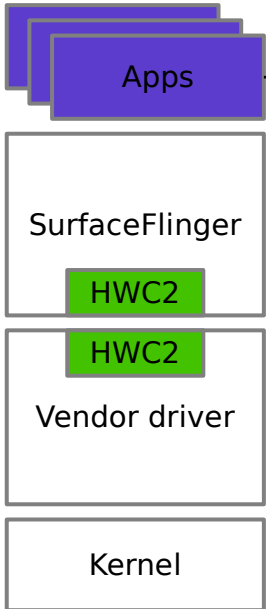
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# Android Graphics Stack





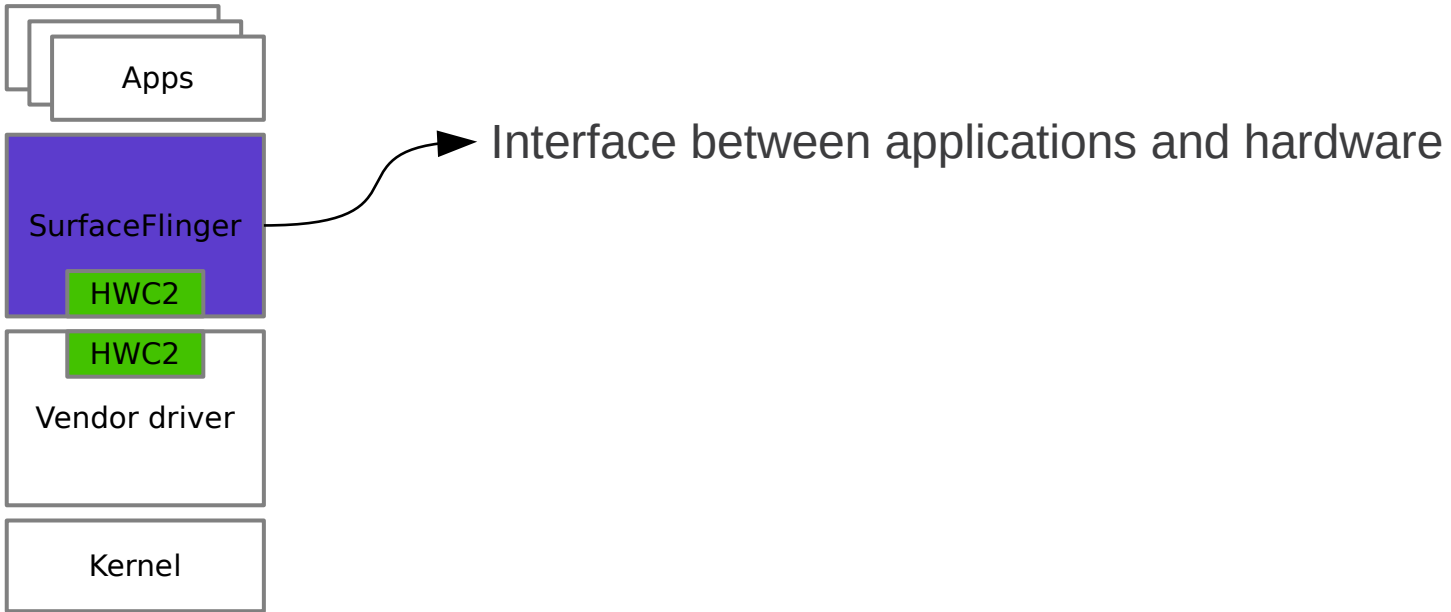
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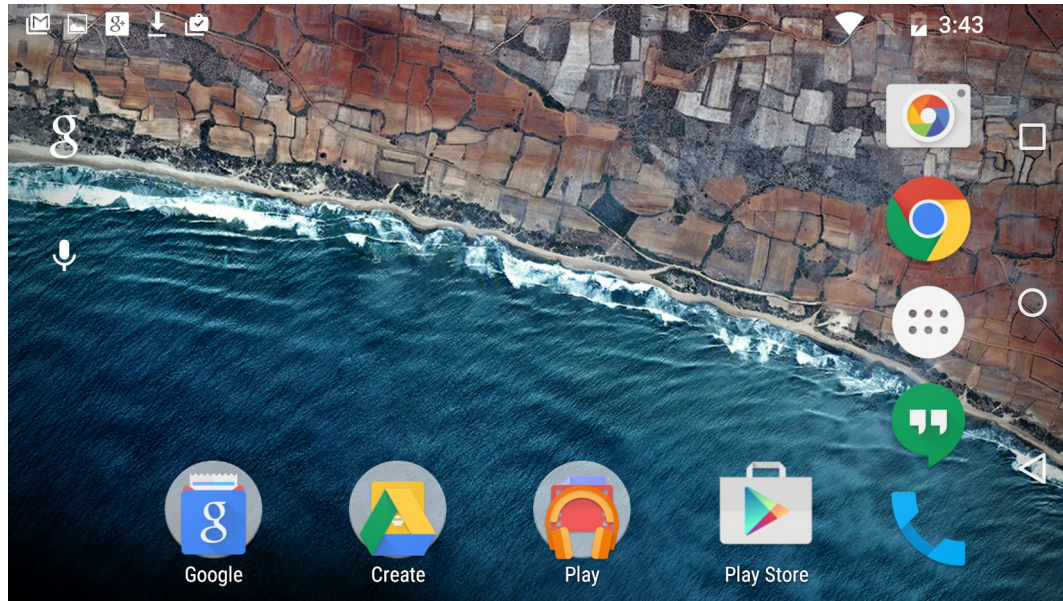
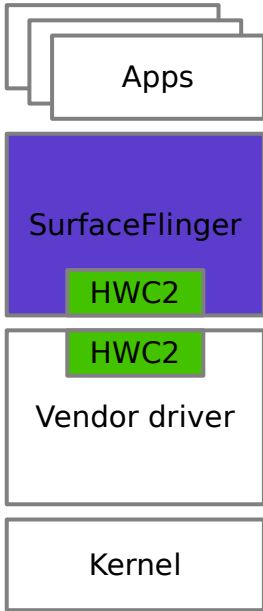
→ The Really Good Stuff™  
- No really, this is the whole point!



# Android Graphics Stack



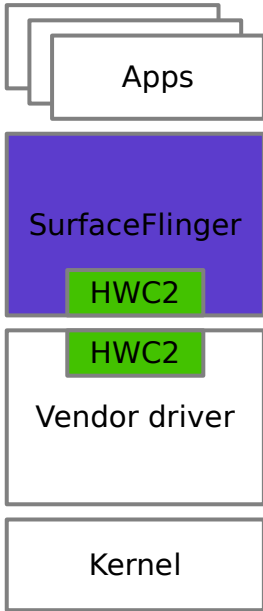
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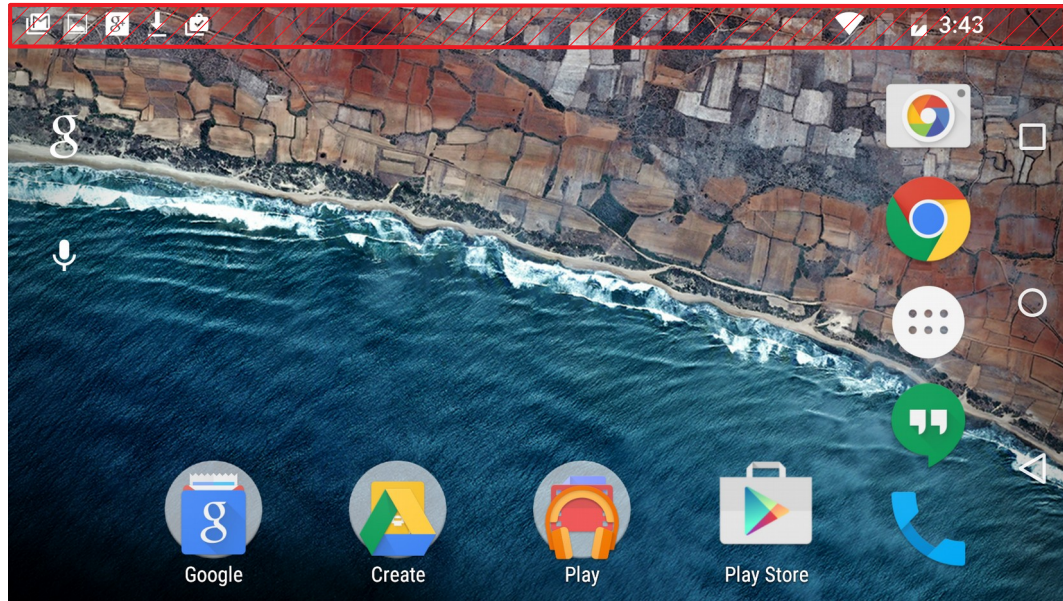


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# Android Graphics Stack



## Status Bar

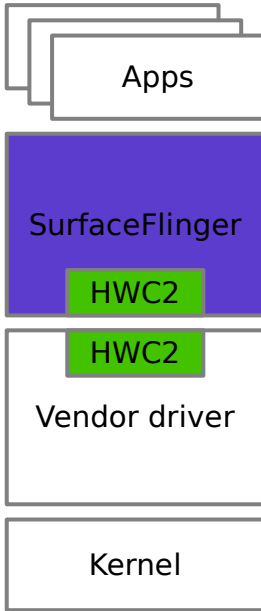




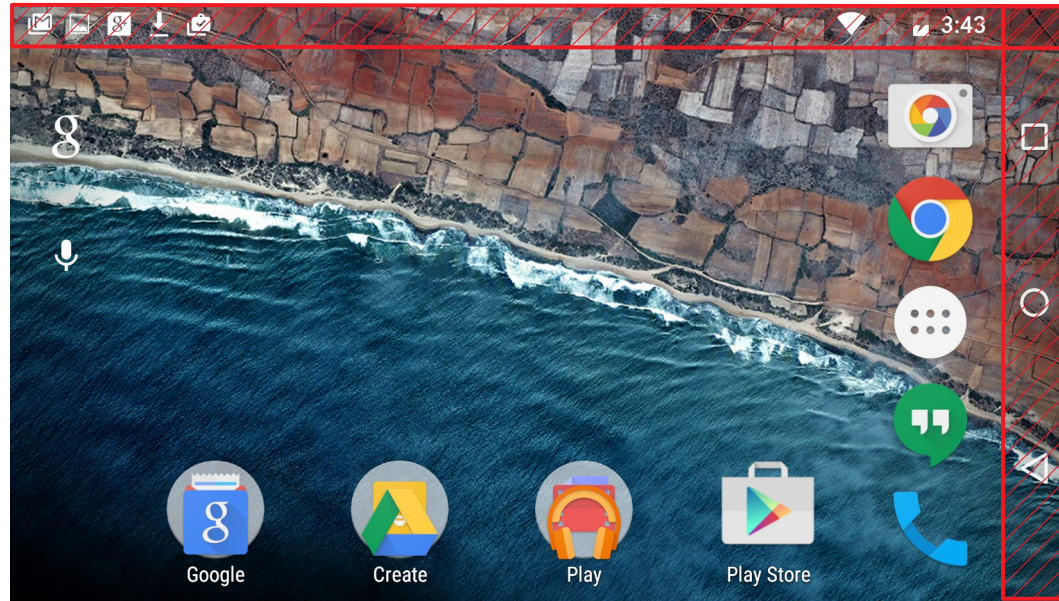


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# Android Graphics Stack



Status Bar

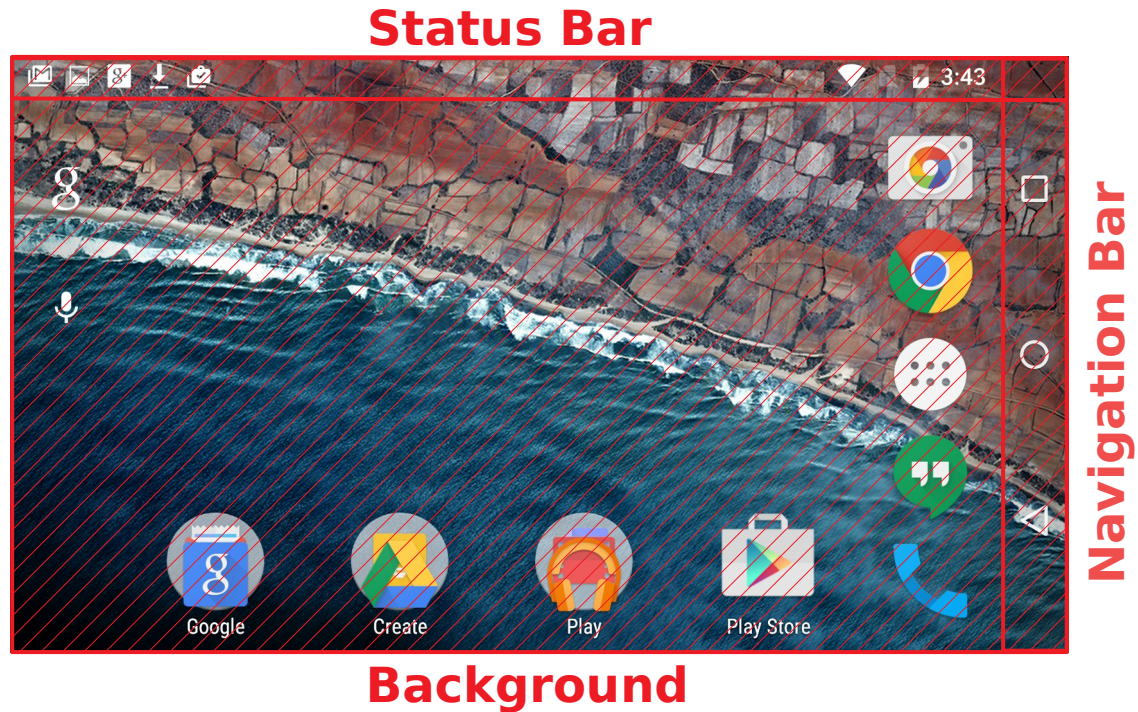
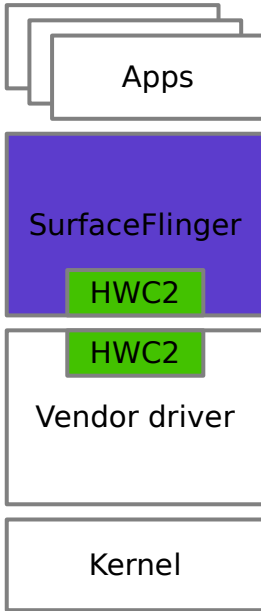


Navigation Bar

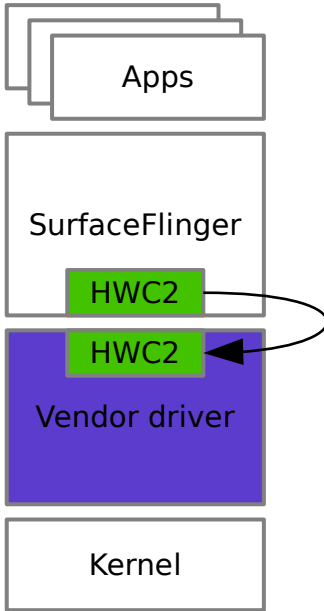


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# Android Graphics Stack



# Android Graphics Stack



SurfaceFlinger speaks HWC to the Composer



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# Android Graphics Stack

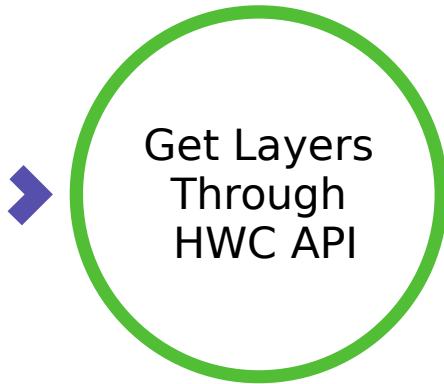
What does the Hardware Composer do?



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What does the Hardware Composer do?

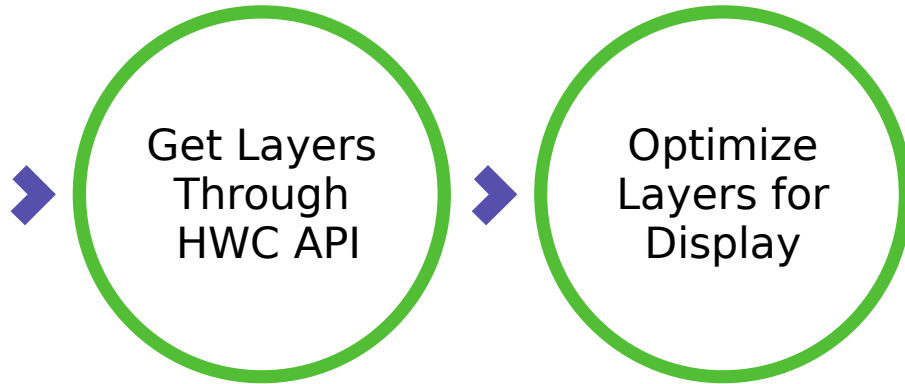




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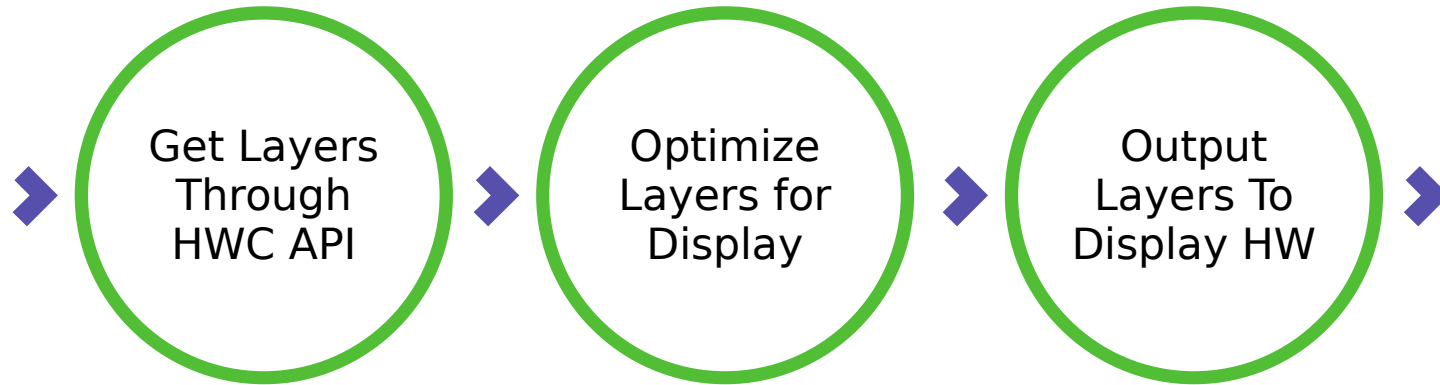




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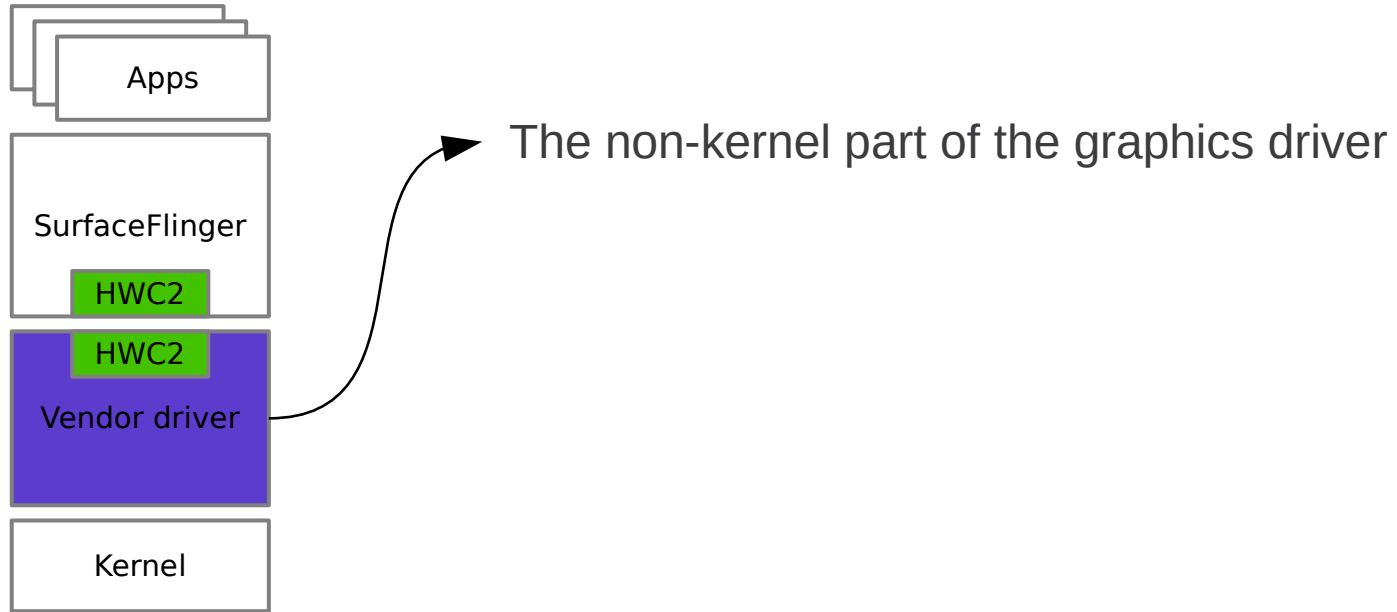
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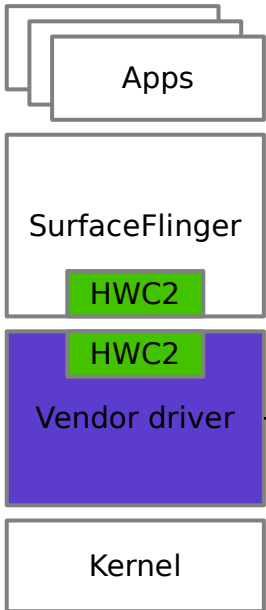
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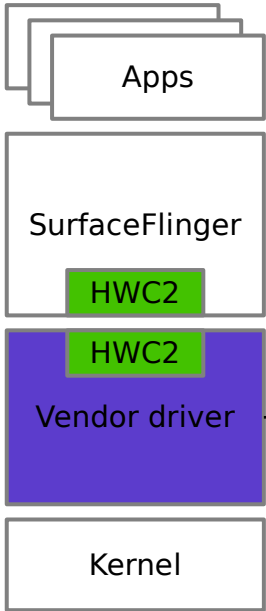
# Android Graphics Stack



The non-kernel part of the graphics driver  
- Hardware Composer



# Android Graphics Stack

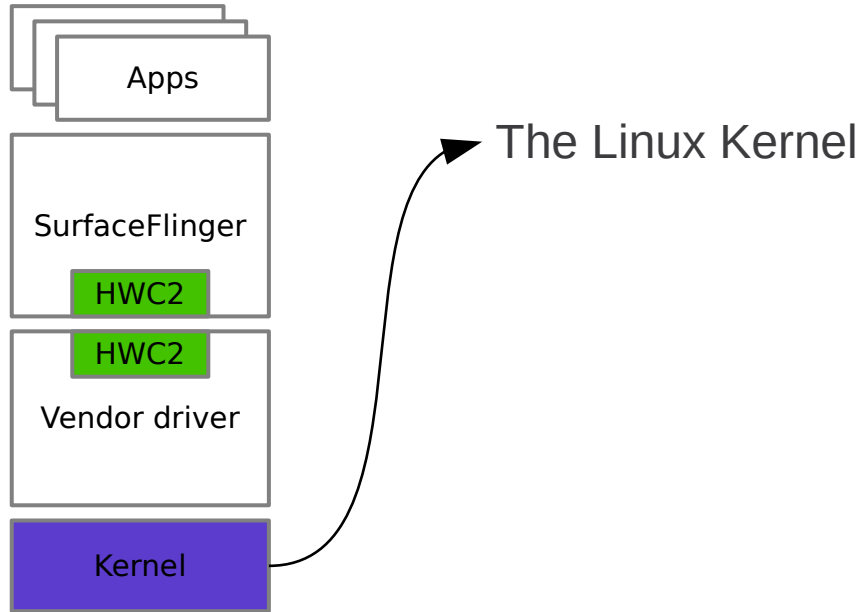


The non-kernel part of the graphics driver

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



# Android Graphics Stack





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# Mainline Graphics Stack

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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
  - `drm_hwcomposer` does!

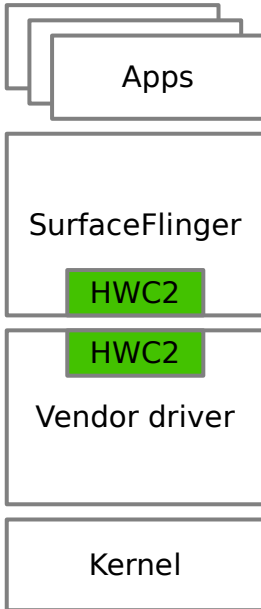




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# Mainline Graphics Stack

What is the Hardware Composer?

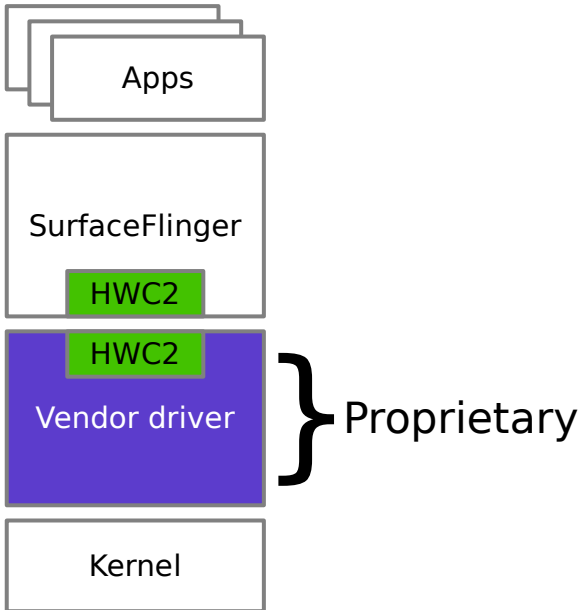




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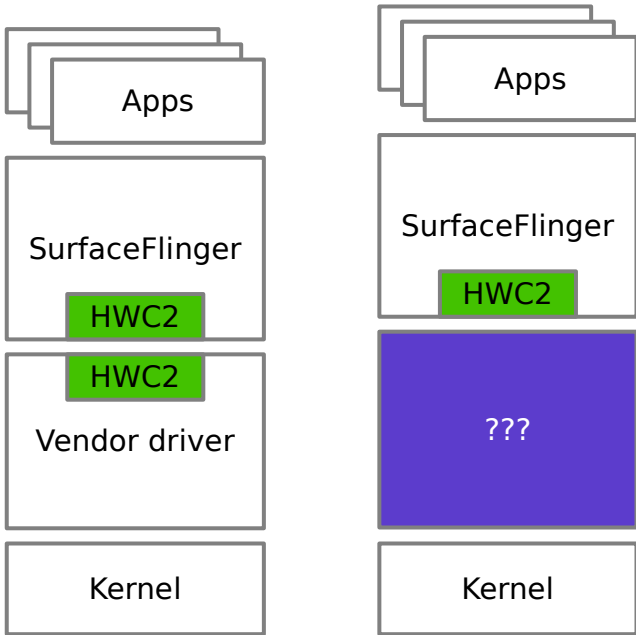
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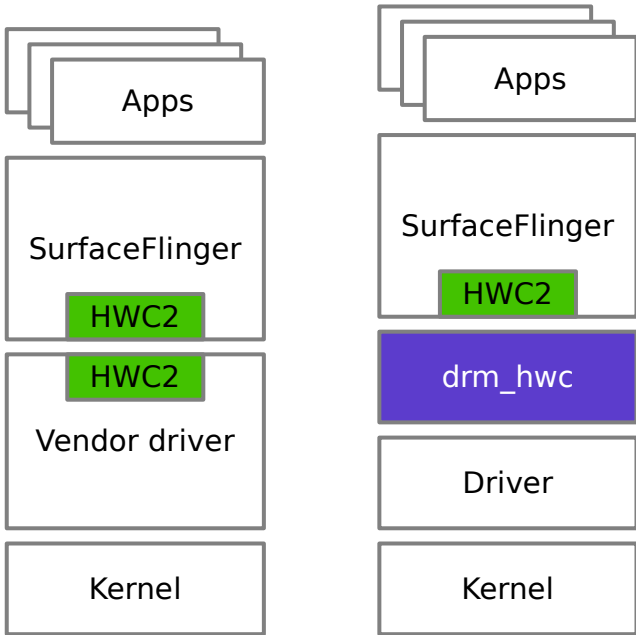
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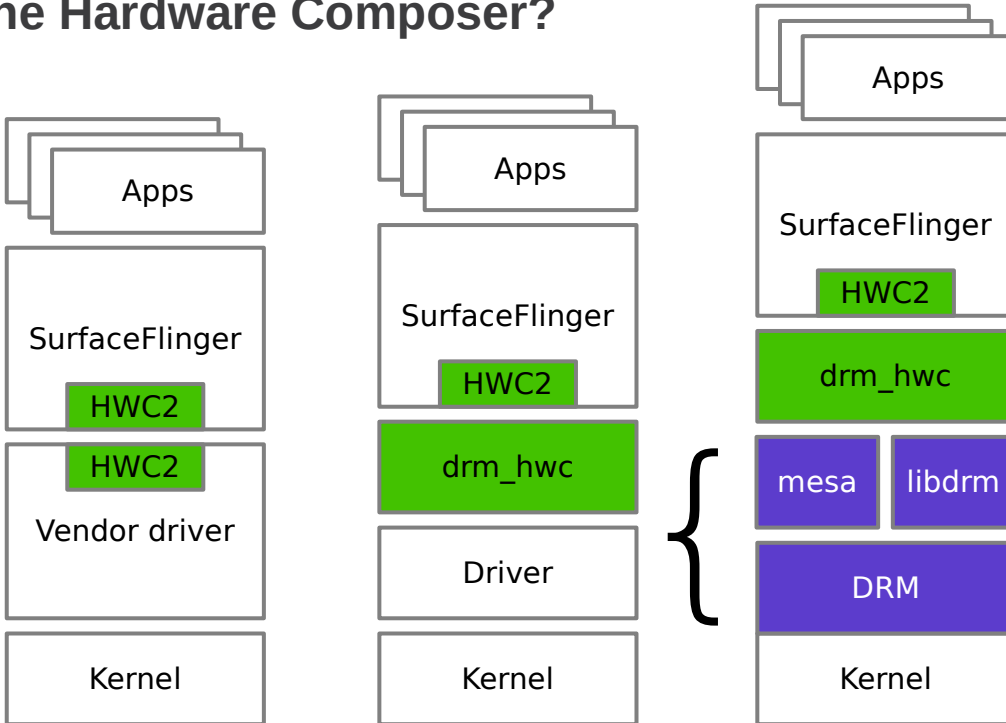
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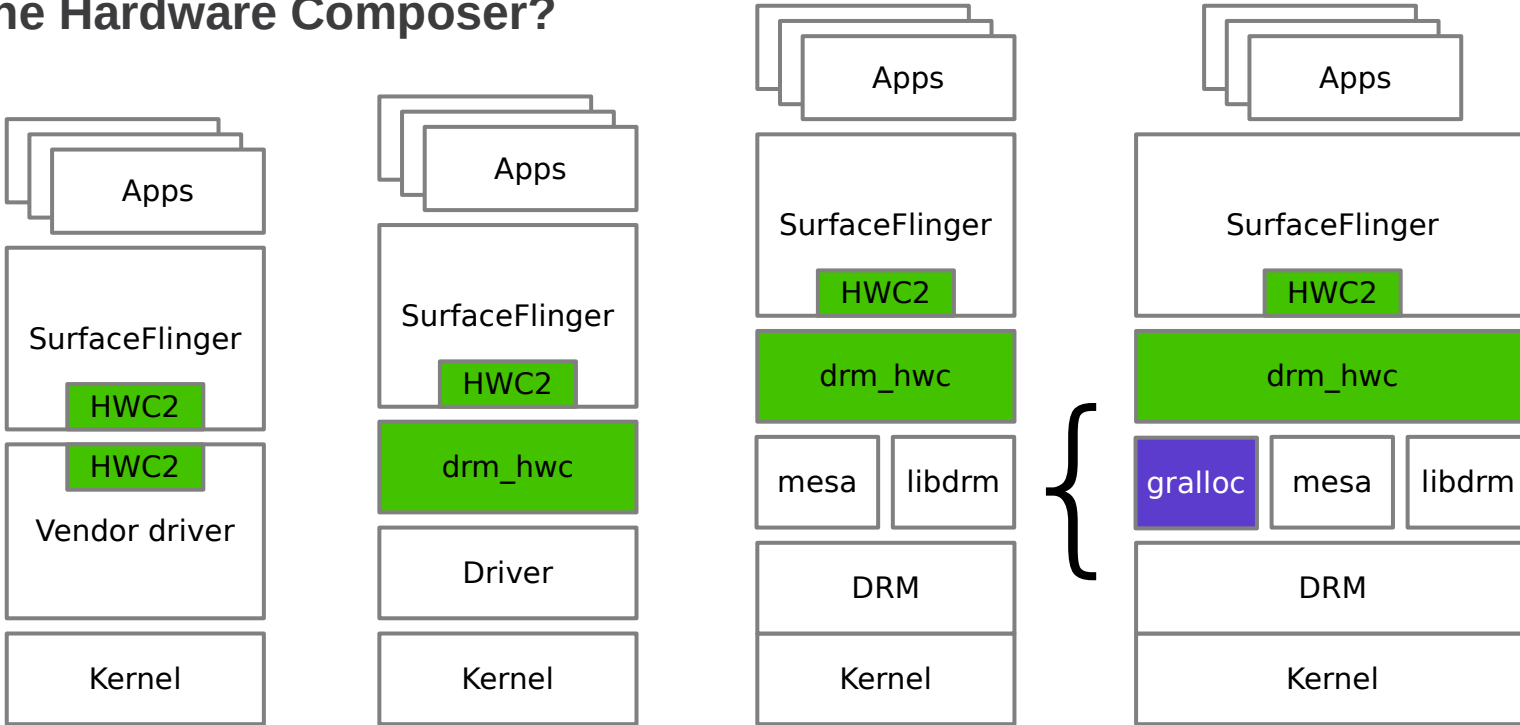
## What is the Hardware Composer?





# Mainline Graphics Stack

## What is the Hardware Composer?





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# drm\_hwcomposer

Project Hosting

- Previously hosted within ChromiumOS



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## Project Hosting

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





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  - Thanks Google:
    - Sean Paul
    - Puneet Kumar
    - Marissa Wall



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# drm\_hwcomposer

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- Contribute at [gitlab.freedesktop.org](https://gitlab.freedesktop.org)



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# Big Picture



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# Big Picture

Merging Android Features

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- A new feature is introduced in Android

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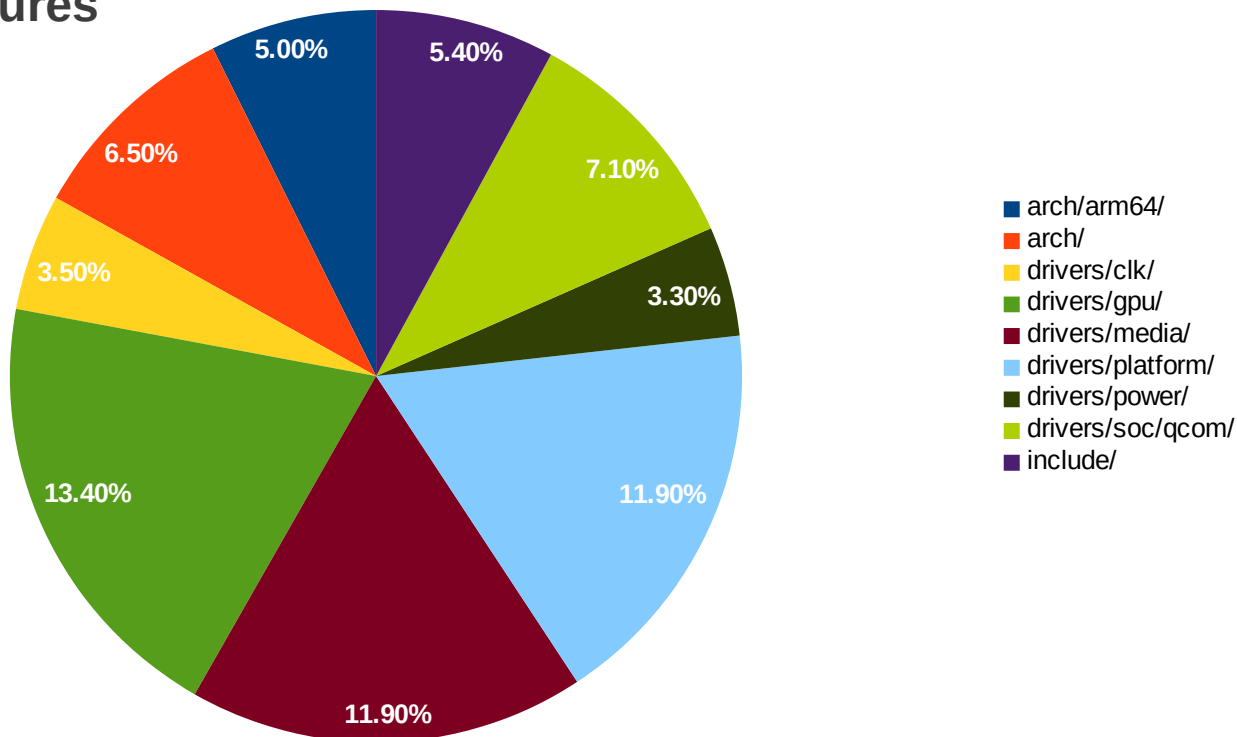
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- This does not to apply to all subsystems



# Big Picture

## Merging Android Features

Qualcomm v4.9 Diff





# Big Picture

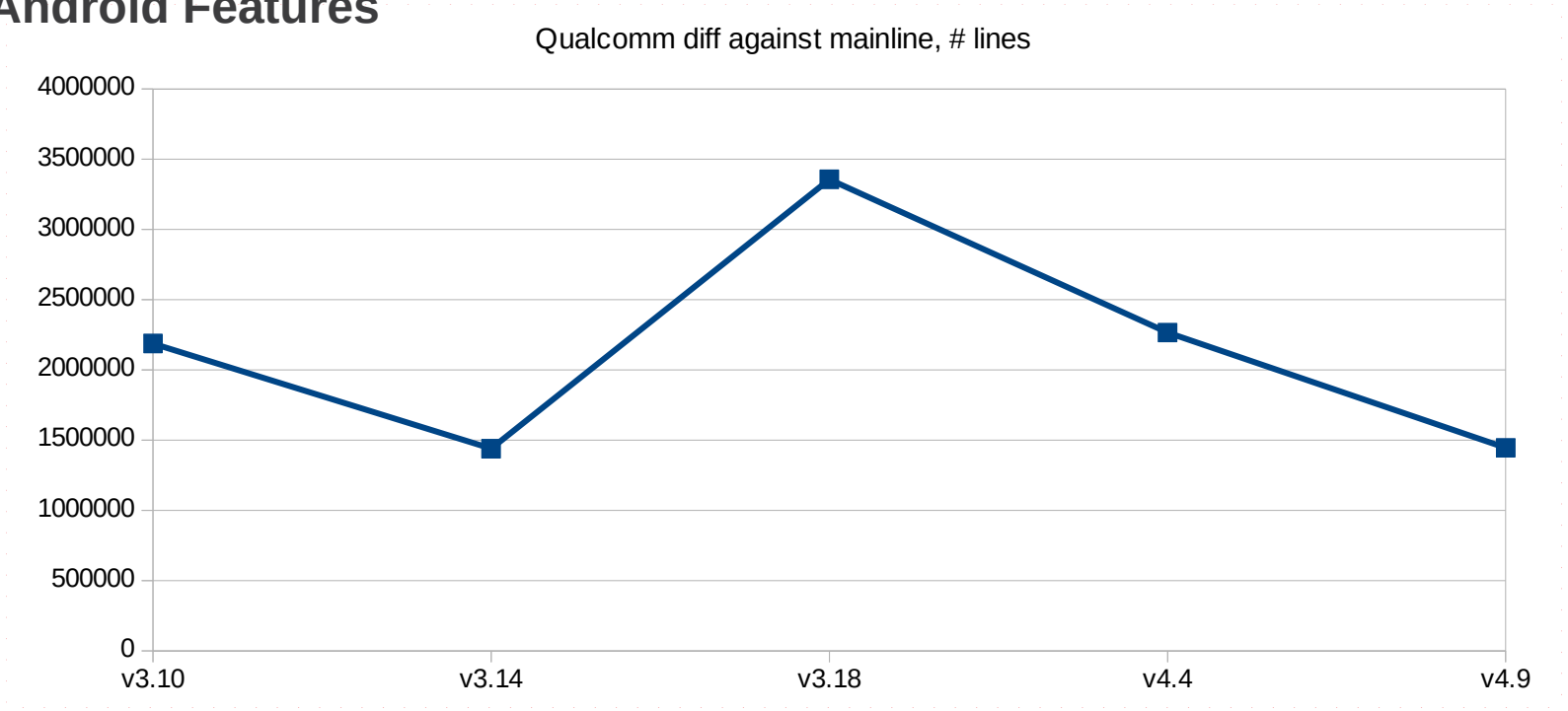
## Merging Android Features

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



# Big Picture

## Merging Android Features





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# Big Picture

Push industry towards Open Source



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Push industry towards Open Source

- Increase device development speed

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- Lower driver development costs



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- Increase driver quality



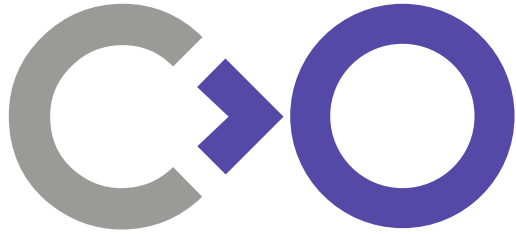
# Big Picture

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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**Thank you!**

@memcpy\_io