Running Android on the Mainline Graphics Stack

Robert Foss
Software Engineer

robert.foss@collabora.com
Agenda

- Why does this matter?
- Android Graphics Stack
- Open Source Graphics Stack
- Current Status
Why?
Why?
Get the latest kernel features
Why?

Get the latest kernel features

• Security fixes
Why?

Get the latest kernel features

- Security fixes
- New features
Why?
Get the latest kernel features

- Security fixes
- New features
- Bug fixes
Why?

Get the latest kernel features

- Security fixes
- New features
- Bug fixes
- Increased performance
Why?

Get the latest kernel features

- Security fixes
- New features
- Bug fixes
- Increased performance
- Lower power usage
Why?
Long term support
Why?

Long term support

- Deliver products with >10 years lifespan
Why?

Long term support

• Deliver products with >10 years lifespan
• Support can be provided from anywhere
Why?

Long term support

- Deliver products with >10 years lifespan
- Support can be provided from anywhere
Why?

Long term support

• Deliver products with >10 years lifespan
• Support can be provided from anywhere
• Hardware support even if the vendor disappears
Why?
Support multiple vendors

- Support multiple hardware vendors with one stack
Why?

Support multiple vendors

- Support multiple hardware vendors with one stack
- Switch hardware vendor at will
Android Graphics Stack
Android Graphics Stack
Android Graphics Stack

- Kernel
- Vendor driver
- HWC2
- SurfaceFlinger
- Apps
Android Graphics Stack

The Really Good Stuff™
Android Graphics Stack

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

Interface between applications and hardware

- Kernel
- Vendor driver
- HWC2
- SurfaceFlinger
- Apps
Android Graphics Stack

Apps
SurfaceFlinger
HWC2
HWC2
Vendor driver
Kernel
Android Graphics Stack

Status Bar

- Kernel
- Vendor driver
- SurfaceFlinger
- HWC2
Android Graphics Stack
Android Graphics Stack

- Kernel
- Vendor driver
- HWC2
- SurfaceFlinger
- Apps

Status Bar
Navigation Bar
Background
Android Graphics Stack

The non-kernel part of the graphics driver
Android Graphics Stack

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

The Linux Kernel

- Kernel
- Vendor driver
- HWC2
- SurfaceFlinger
- Apps
Android Graphics Stack

What's the HWC2 API?

- Kernel
- Vendor driver
- HWC2
- SurfaceFlinger
- Apps
Android Graphics Stack

What’s the HWC2 API?

- API used between SurfaceFlinger and hardware
Android Graphics Stack

What’s the HWC2 API?

- API used between SurfaceFlinger and hardware
- Compose layers to the screen
Android Graphics Stack

What’s the HWC2 API?

- API used between SurfaceFlinger and hardware
- Compose layers to the screen
- Abstract graphical objects
Android Graphics Stack

What's the HWC2 API?

- API used between SurfaceFlinger and hardware
- Compose layers to the screen
- Abstract graphical objects
- Offload work from GPU to compositor hardware
Open Source Stack
Open Source Stack

Where does the OSS stack fit in?

- Kernel
- Vendor driver
- SurfaceFlinger
- Apps
  - HWC2
Open Source Stack
Where does the OSS stack fit in?

Kernel
Vendor driver
SurfaceFlinger
Apps

HWC2
HWC2
HWC2
Proprietary
Open Source Stack

Where does the OSS stack fit in?

- Kernel
- Vendor driver
- SurfaceFlinger
  - HWC2
- Apps

Diagram:

- Kernel
- SurfaceFlinger
  - HWC2
- Apps
- ???
Open Source Stack

Where does the OSS stack fit in?

- Kernel
- Vendor driver
- SurfaceFlinger
- HWC2
- drm_hwc
- Driver
- Kernel
- Apps
- HWC2
- HWC2
- HWC2
Open Source Stack

Where does the OSS stack fit in?
Current Status
Current status
Why now?
Current status

Why now?

- Kernel Buffer Synchronization support
  - Inspired by Android kernels, now in mainline
  - Some GPU drivers now support this
Current status

Why now?

- Kernel Buffer Synchronization support
  - Inspired by Android kernels, now in mainline
  - Some GPU drivers now support this

- Atomic Display Framework API
  - Most drivers implement this
Current status

Tested platforms
Current status

Tested platforms

- iMX6
  - GPU: Vivante GC3000
Current status

Tested platforms

- Dragonboard 410c
  - GPU: Adreno 306
Current status

Tested platforms

- MinnowBoard Turbot
  - GPU: Intel HD graphics
Thank you!
Questions?