

# Android and Linux Kernel

Herding billions of penguins, one version at a time

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12 November, 2018

# Agenda

Life of Android device kernels

“The Android Problem(s)”

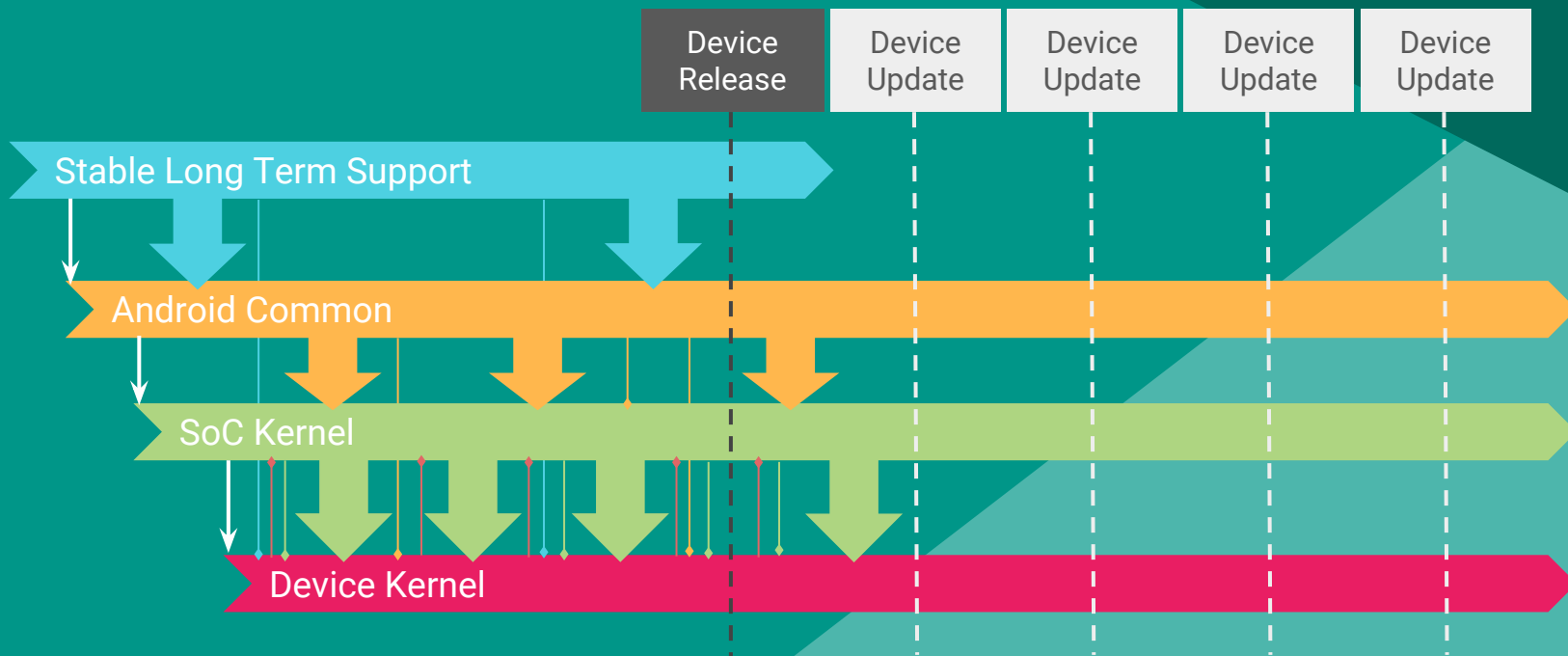
... and their solutions.

Android Kernel Development Process

Project Treble & Kernel

Questions

# Life of Android device kernels



# The Android Problem(s)

Shipping older kernels

Manage multiple kernel versions

Slower (non-existent) kernel updates

Lack of automated continuous testing of latest kernels with Android.

Inability to run and test mainline kernels with Android

Millions of lines of out-of-tree code.

# Problem #1 & 2: Older & Multiple kernels

- Android Oreo: 3.18, 4.4 & 4.9
- Android Pie: 4.4.107+, **4.9.84+**, 4.14.42+
  - ~2 year delay.
- Android platform MUST continue work on following kernel versions.
  - 3.18, 4.4, **4.9, 4.14, 4.19**

# Managed with testing

- LKFT tests of LTS, rc, android common...
- kernelci testing of android common kernels
- LTP improvements: syscall coverage, fixing breakage
- Pre-submit testing on Android kernels using “Cuttlefish”
- Testing from SoC vendors.

# Problem #3: Slower (non-existent) kernel updates

- Major/minor kernel upgrade is still an issue with carriers and vendors alike.
- Android Oreo: Minimum kernel version defined and required.
- Android Pie: Minimum kernel version with LTS defined and required.
- Plan to continue moving the needle.
- Include LTS releases instead of Patches in security bulletin
  - “A bug is a bug is a bug”.

# Problem #4 & 5: Lack of testing targets for Android

- None of the Android devices run mainline kernels.
- Problem for both Android & kernel developers.
- Large amounts of out-of-tree code.
  - Android common
  - Hardware support



# Problem #6: Millions of lines of out-of-tree code

- Android common kernel
  - Many patches have been merged upstream or are now obsolete for v4.19
  - Android v4.19 kernel has about ~30 patches.
    - 83 files changed, 6474 insertions(+), 173 deletions(-)
    - Numerous changes are dropped in v4.19 as a result of deprecation, user space alternatives and / or upstreaming.
  - Work yet to be upstreamed:
    - Binder priority inheritance, EAS, SDCardFS etc.

## Problem #6: ...

- Upstreaming out-of-tree hardware specific code...



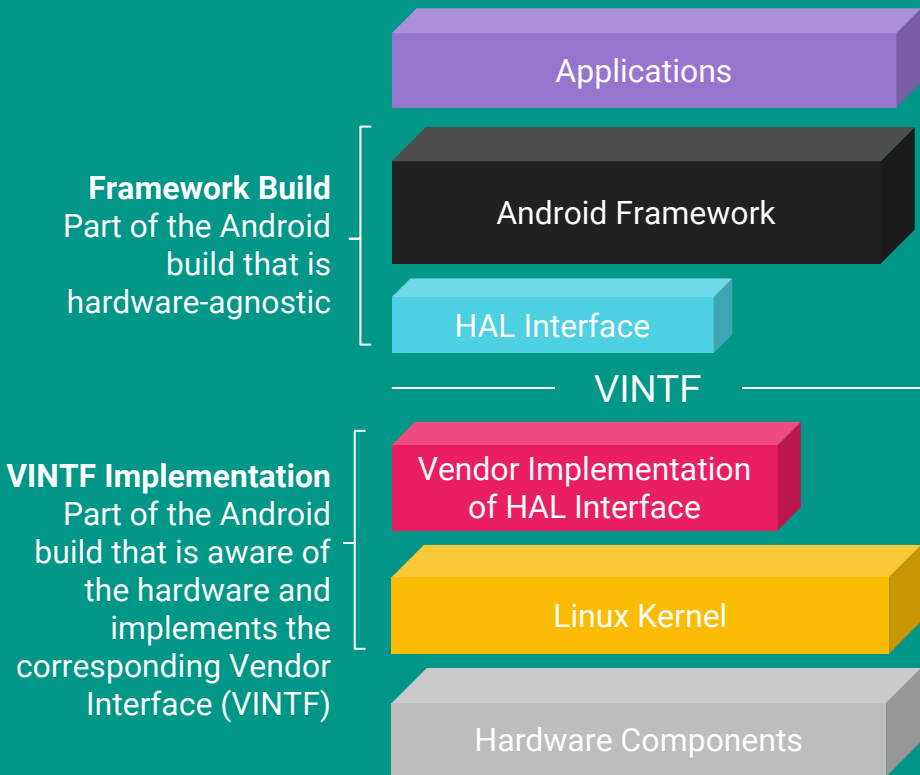
(.. but more on this later)

# Android kernel development Process updates

- Upstream first!
- Proactively report vulnerabilities and work w/ Upstream.
- Mainline, -next, -stable testing on ARM hardware.
  - Same done with Cuttlefish on emulated hardware.

# Project Treble & Kernel

- **Vendor Interface (VINTF)**
  - Collection of versioned HAL interfaces
  - **Linux Kernel**
- ....
- Generic System Image (GSI)



# Platform vs Vendor Split



android

Vendor Implementation of HAL Interface



# Make a “Generic” kernel possible for Android



GSI

+



GKI

Vendor Implementation of HAL Interface

Linux Kernel Modules for SoCs / Peripherals

# How can we get there ...

- Kernel symbol namespaces
- Single compiler for Android
  - Both userspace and kernel.
- In-kernel ABI monitoring

# More updates in Android MC

- Userspace low-memory killer
- Userdata checkpoints
- De-staging: Ashmem, Ion.
- DRM/KMS
- Updates on Android's use of Device Tree.
- LVM, Android and resizable partitions.



Questions?