Android and Linux Kernel
Herding billions of penguins, one version at a time

Sandeep Patil
13 November, 2018
kernel-team@android.com

android

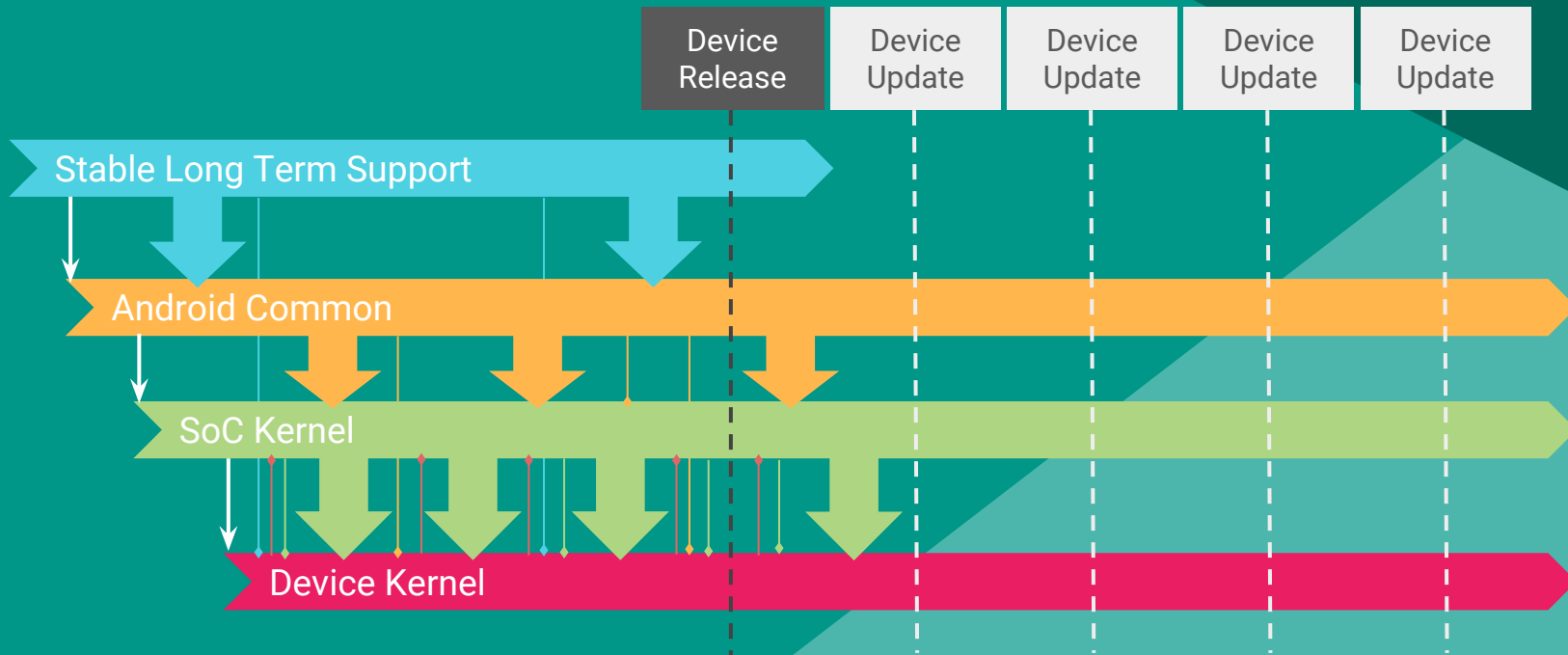# Agenda

Life of Android device kernels

"The Android Problem(s)"

    … and their solutions.

Android Kernel Development Process

Project Treble & Kernel

Questions

android

Life of Android device kernels

Device Release

Device Update

Device Update

Device Update

Device Update

Stable Long Term Support

Android Common

SoC Kernel

Device Kernel

android

The Android Problem(s)

Shipping **older** kernels

Manage **multiple** kernel versions

Slower (non-existent) kernel updates

No CI for kernels!

Can't run/test mainline kernels with Android

Millions of lines of out-of-tree code.

android

Older, Multiple kernels

- Oreo: 3.18, 4.4 & 4.9

- Pie: 4.4.107+, **4.9.84+**, 4.14.42+

  - ~2 year delay.

- Android MUST continue to work on following kernel versions.

  - 3.18, 4.4, **4.9, 4.14, 4.19**

android

Adding CI

- 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.

android

Non-existent kernel updates

- Kernel upgrades a huge issue with carriers and vendors alike.

- Oreo: Minimum kernel version defined and required.

- Pie: Minimum kernel version with LTS defined and required.

- Continue moving the needle.

- Include LTS releases instead of Patches in security bulletin
    - "A bug is a bug is a bug".

android

No testing targets

- 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

android

Millions of lines of out-of-tree code

- Android common kernel
  - A lot has merged upstream
  - Android v4.19 kernel has **only** about ~30 patches (yay!).
    - 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:
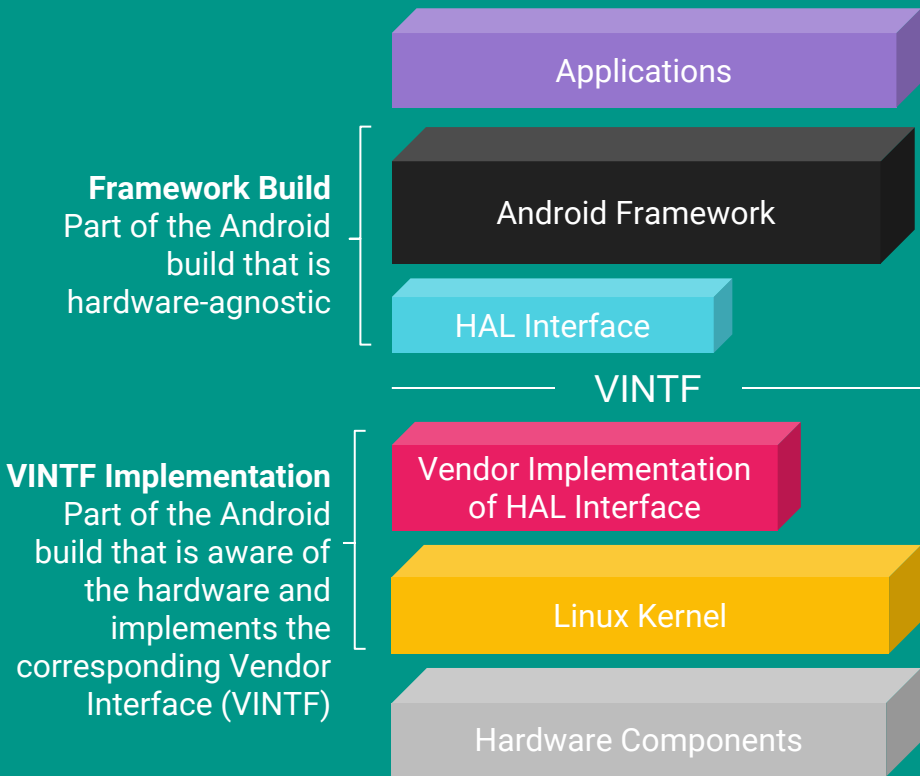   - Binder priority inheritance, EAS, SDCardFS etc.

android

Upstreaming out-of-tree HW-specific code

¯_(ツ)_/¯

(.. but more on this later)

android

Project Treble & Kernel

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

Applications

Framework Build
Part of the Android build that is hardware-agnostic

Android Framework

HAL Interface

VINTF

VINTF Implementation
Part of the Android build that is aware of the hardware and implements the corresponding Vendor Interface (VINTF)

Vendor Implementation of HAL Interface

Linux Kernel

Hardware Components

android

Platform vs Vendor Split

Vendor Implementation of HAL Interface

android

G is for Generic

GSI   +   GKI

Vendor Implementation of HAL Interface

Linux Kernel Modules for SoCs / Peripherals

android

How can we get there …

- Kernel symbol namespaces

- Single compiler for Android

  - Both userspace and kernel.

- In-kernel ABI monitoring

android

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.

android

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.

android

Questions?