Android Consolidation: Problem Statement

- Supporting Android on each platform requires development, test, support and maintenance of whole software stack consisting of Trustzone, bootloader (fastboot), kernel, and Android HALs
- How to support 2, 10, or 96 different boards?
- No upstream for Android HALs
- Fragmented kernel driver interfaces
Android Consolidation: Goals

- Develop kernel support once across distros (Android, ChromeOS, traditional Linux)
- Mainline kernels just work
- Eliminate need for custom HALs
- Make adding devices and updating to new Android versions easier
- Create an upstream community for Android devices
How is this relevant to LITE?

- The kernel is the HAL
- IoT userspace is fragmented
- Brillo reuses everything Android
- Consolidation is working to address
- Stay in front of problems now or create “IoT Consolidation Project” later
Common Areas of Interest

- WiFi, BT, NFC
- Sensors
- Camera
- Low-level (Project Ara)
  - GPIO
  - I2C
  - SPI
  - UART
  - PWM
WiFi/BT (and NFC, Zigbee)

- Get mainline drivers to work OOTB
- Create proper kernel BT drivers
- UART slave support (part of kernel consolidation)
- Switching between modes (AP, client, P2P)
- Custom ioctls for Miracast/Chromecast
- Impacts of BLE, 6LoWPAN, etc.
Sensors

- IIO is the defacto standard for the kernel
- Userspace library is libiio: https://wiki.analog.com/resources/tools-software/linux-software/libiio
- Sensors range from simple to complex
  - Phones: discrete sensors to sensor hubs
  - Programmable processing graphs in FPGAs
Camera

- Camera sensor drivers coupled to SoC CSI drivers
- Little support upstream
- Need to extend V4L2 API
Low-level APIs

- For when a kernel driver is not possible
- Wrappers around direct sysfs or /dev access
- Several libraries to choose from:
  - libmraa/upm - run-time config, BSD, community
  - libsoc - build-time config, LGPLv2.1, 1 developer
- Identification by function/location a problem
  - Per board config files doesn’t scale
  - Need to provide userspace with additional information.
GPIO

- New kernel ABI to address issues
  - Kernel’s GPIO number space exposed
  - No way to retrieve a GPIO by function
  - No way to control multiple GPIOs together
  - No way to handle hotplug of GPIOs

- Needs DT bindings to describe functions
Add-on and daughter boards

- Capes, Shields, Hats, Lures
- Some designs have EEPROM for ID, but many don’t (96boards)
- DT overlays to the rescue (almost)
  - Userspace interface to apply overlays
  - How to apply overlays in firmware/bootloaders
  - Describe connectors to decouple overlay from base DT