



**Linaro
connect**
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HALs for LITE

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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
 - Work to adapt V4L2 media controller for IIO: https://www.linuxtv.org/downloads/presentations/mc_ws_2015/iio_media_controller.pdf

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