ANDROID THINGS* -HIGH LEVEL INTRODUCTION

Open IoT Summit, Feb '17

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android things

AGENDA

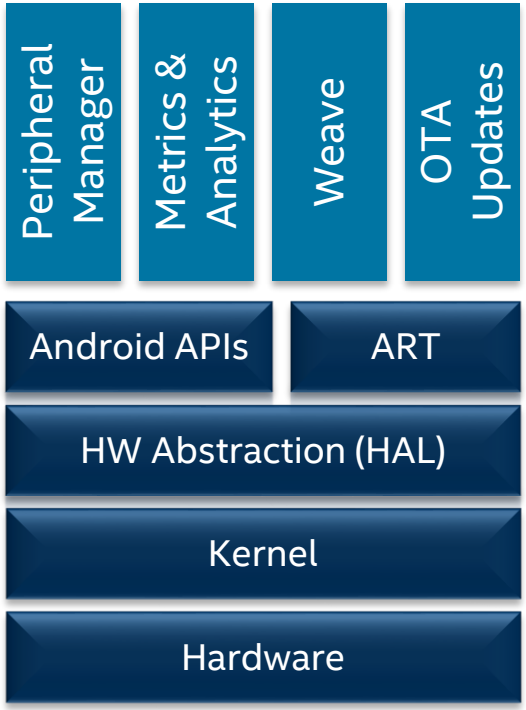
- Android Things* Overview
- Architecture
- Getting started
- Code Samples
- Resources
- Q & A

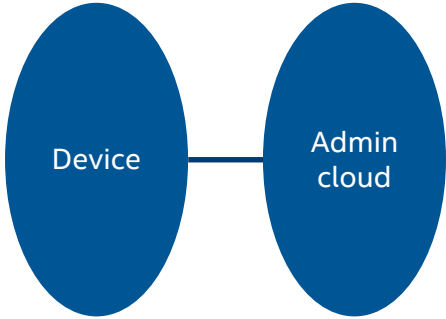
WHAT IS ANDROID THINGS*?

Google's OS for IoT devices

Android
- Apps

+ Peripheral Manager
+ Developers Console
+ Metrics & Analytics
+ Weave
+ 6LowPan, Threads
+ A/B OTA updates with auto rollback





ANDROID THINGS* FEATURES

Features	Android Things
Memory Footprint	**< 500 MB**
Public Availability	**Developers Preview 1- Dec '16** **Developers Preview 2 - Feb '17**
Android SDK	**Developers Preview 1**
Android Runtime	**Developers Preview 1**
Android APIs	**Developers Preview 1**
Device Usage Metrics	Future Release
Security	Future Release
Crash Reporting	Future Release
Developer Console	Future Release
OTA Updates	Future Release
Weave	Future Release

Download images for DP2.

File bug reports and feature requests.

Ask questions on stackoverflow.

Join Google's IoT Developers Community on Google+

WEAVE*

Open communication platform with cloud service.

- Device setup
- Cloud infrastructure
- Control from Google Assistant
- Device interoperability
- Developer console

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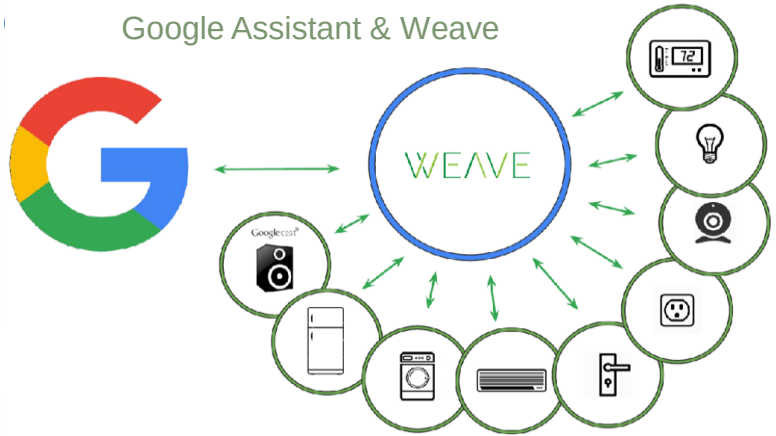


IOTIVITY*

Open Connectivity Foundation (OCF)

- Publishes open IOT standards for device-to-device communication

IoTivity

- Implementation of OCF IOT standards

WHY ANDROID THINGS*?

IOT challenges

- Complex technologies
- Interoperability
- Security
- Scalability

"OS-AAS" AND "SOM"

Google*

- Generates and signs all images
- Provides Operating System updates for certified devices
- Pushes updates for device applications.

Intel

- Provides Google with Board Support Packages ("BSPs")

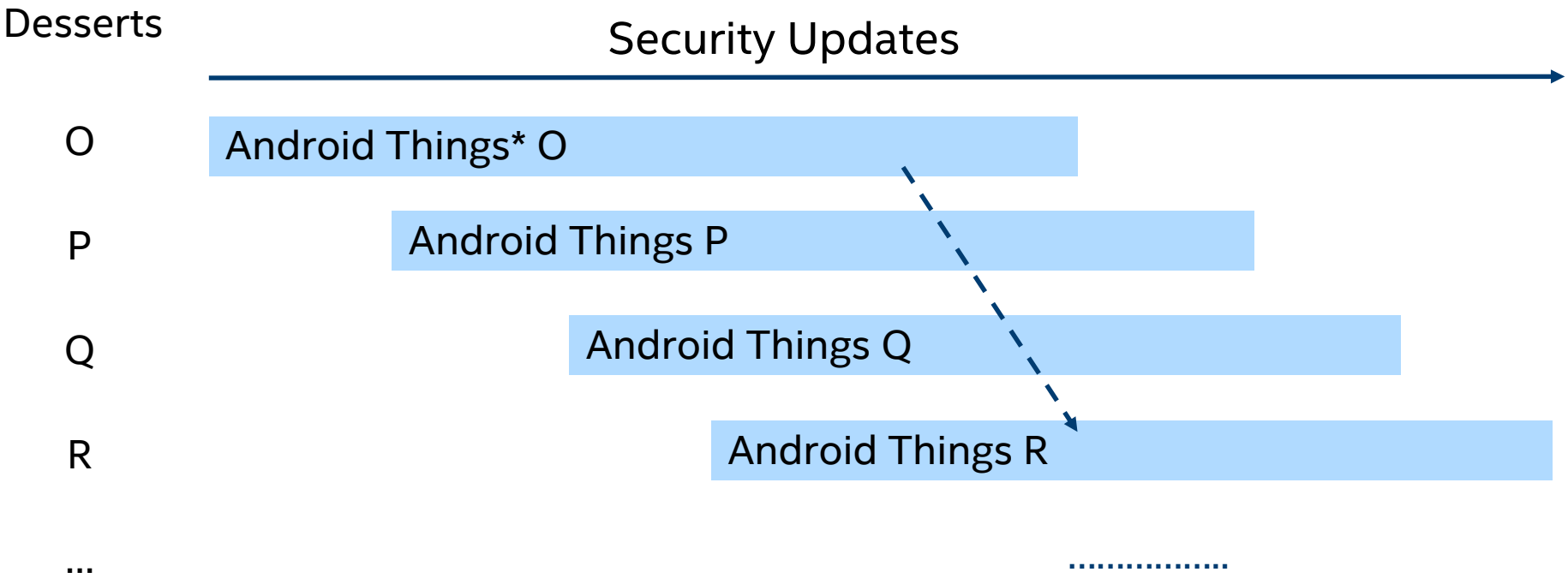
OEMs

- Provide HALs for sensors and actuators as APKs.
- Provide business differentiation as applications.

System-on-a-Module

Incorporates SoC, PMIC, memory, storage, networking, BIOS

LONG TERM SUPPORT



ANDROID THINGS* SUPPORT ON IA

	Developer Board / POC	SOC	Android Things Status
	Intel® Edison Board for Arduino	Merrifield	Supported in DP1
	SparkFun* Blocks with Intel Edison	Merrifield	Supported in DP1
	Intel® Edison w/ Mini Breakout Board	Merrifield	Supported in DP1
	Intel® Joule™ Compute Module	Broxton-M	Supported in DP2

Summary

Certified Hardware

Build your devices on certified development boards that include the SoC, RAM, wireless radios, and more.

Time to Market

Decrease initial costs and time to market by taking advantage of low cost development hardware and pre-implemented drivers for common peripherals.

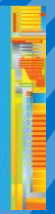
Build to Scale

Work with SoC vendors directly to scale volume and optimize board design, knowing your devices run on a proven and production-ready platform.

Google Services

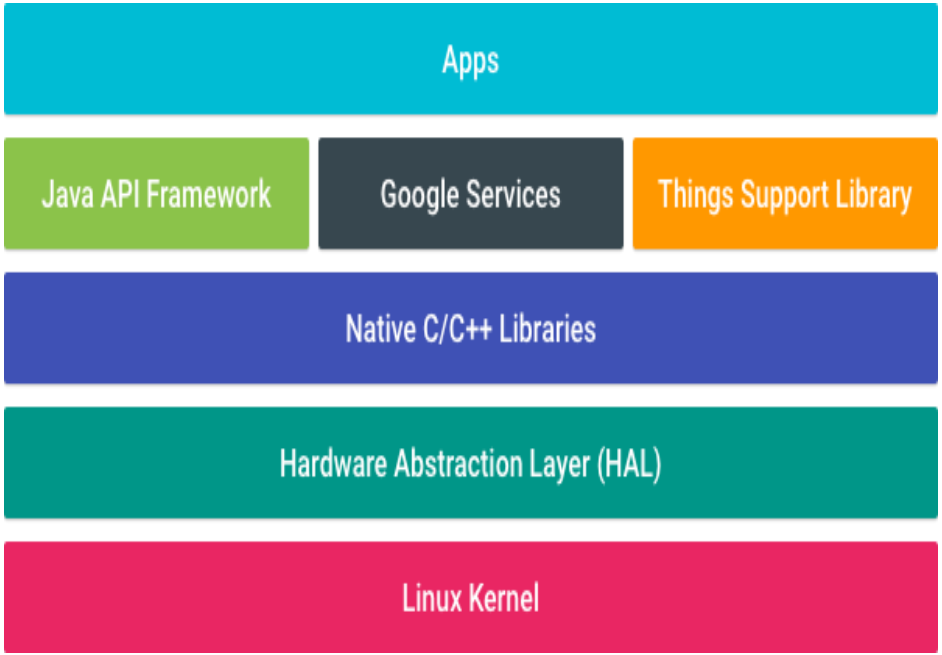
Take advantage of Android Ecosystem. Google Managed updated. Android GMS services, Google Cloud Platform
(1H2017 Weave, TensorFlow)

Android Things* Architecture



ANDROID THINGS* ARCHITECTURE

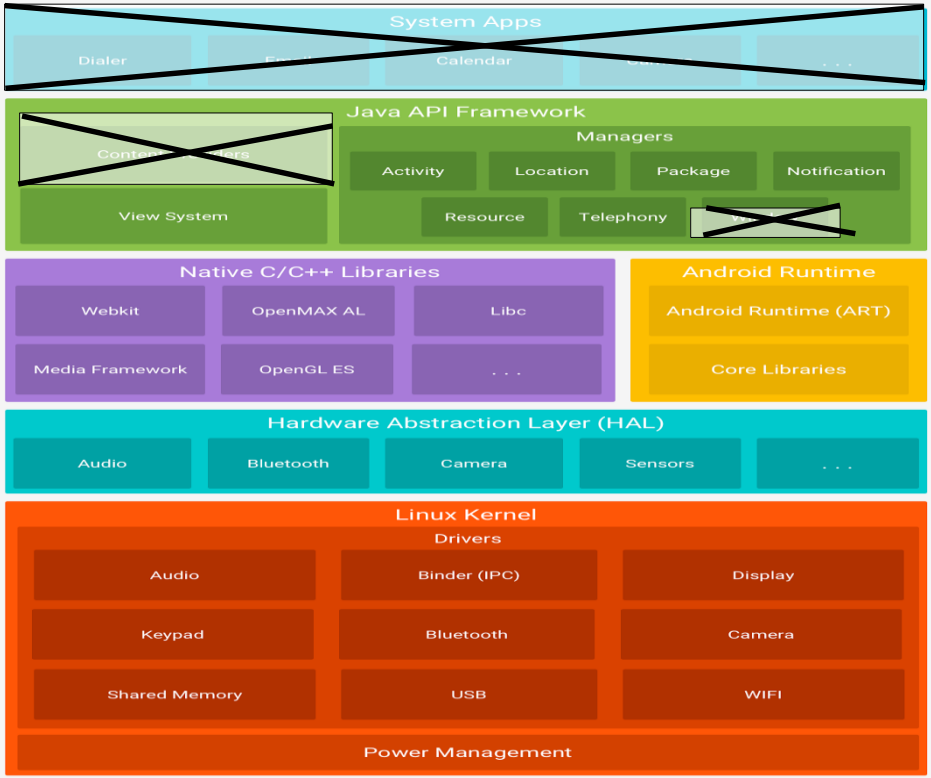
- Java API framework
- Google Services
- API Level 7.0 (Nougat)
- Graphics optional
- Things Support Library
- OTAs received directly from Google.



DIFFERENCES BETWEEN ANDROID* AND ANDROID THINGS*

Android Things

- Standard system apps and content providers absent
- Most of the Google APIs for Android are supported
- APIs that require user input/authentication credentials aren't available.



Graphic Source: Google

DIFFERENCES BETWEEN ANDROID* AND ANDROID THINGS*

Android Things

- doesn't include the standard suite of system apps and content providers
- supports most of the Google APIs for Android
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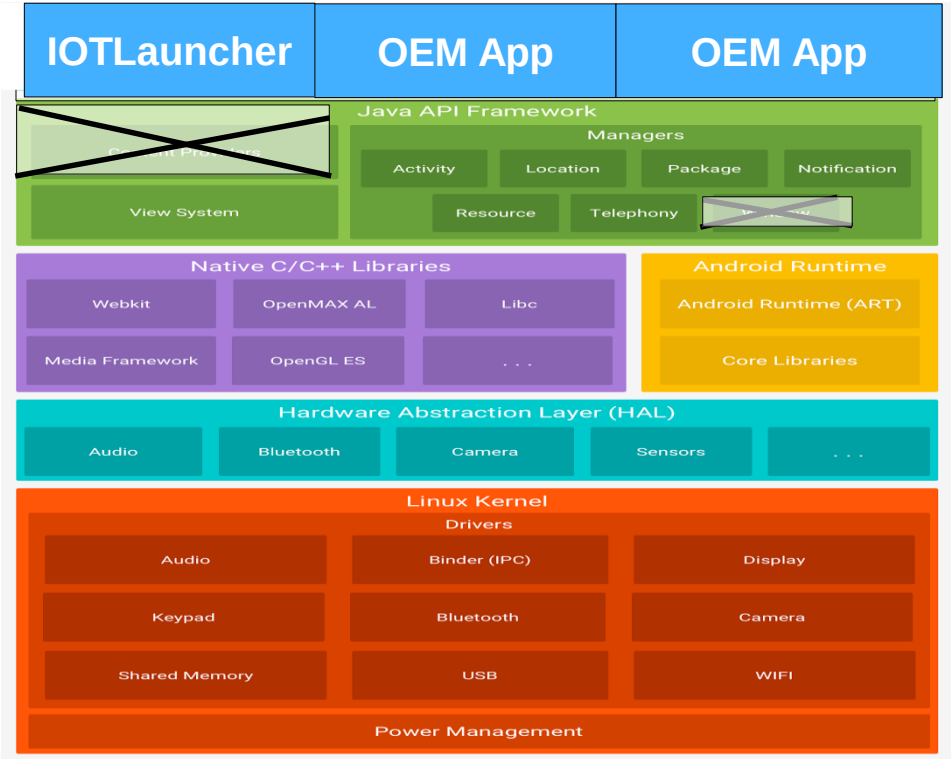
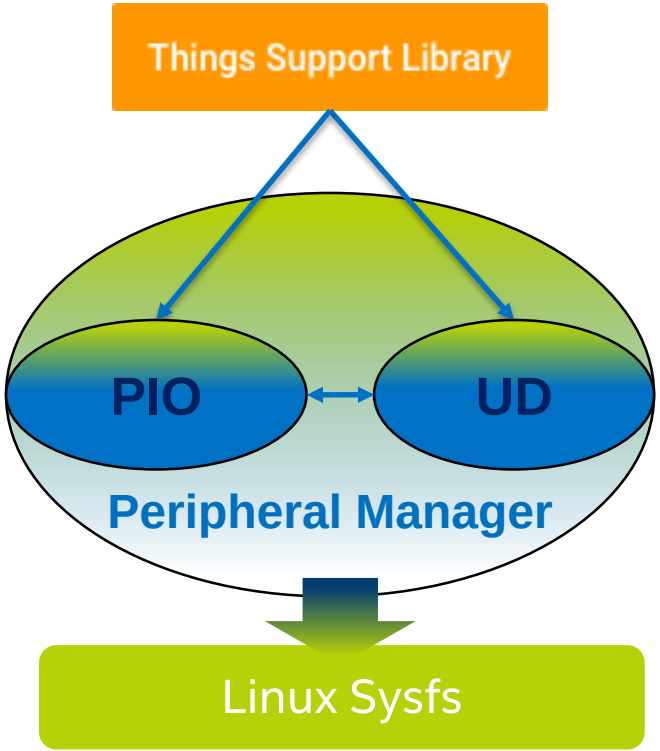
App is automatically started on startup



Graphic Source: Google

THINGS SUPPORT LIBRARY

- Peripheral IO APIs
  - Enables Apps to talk to sensors and actuators
  - Interfaces supported GPIO, I2C, UART, PWM, SPI.
  - Mutual Exclusion
- User driver API
  - Allow apps to inject hardware events into framework that other apps can use.



Graphic Source: Google

ANDROID THINGS* SECURITY FEATURES & REQUIREMENTS

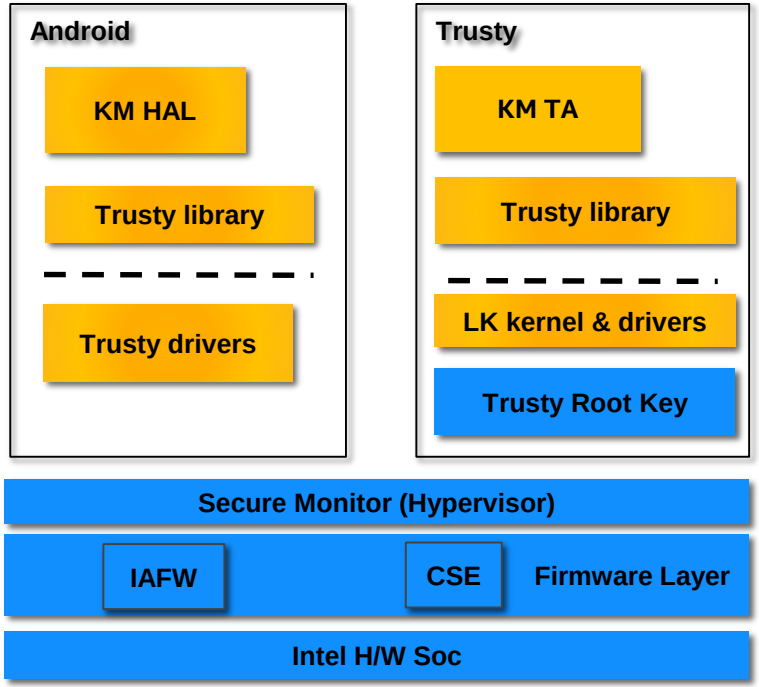
Security Requirements from Google* are largely the same as Android:

- SE-Linux* Enforcement
- Android* Verified Boot, Cryptographic Chain of trust
- Google Android Trusty*
- HW Keymaster 2.0
- No Gatekeeper*

Various partner and web documents are available to fully understand the boot-flows and key-store requirements

INTEL'S SOLUTION FOR TRUSTY

1. Consolidated Security Engine generates the Trusty Root Key from platform unique device key. (hardware root of trust).
2. The Bootloader obtains the Trusty Root Key from Consolidated Security Engine and passes the Trusty Root Key to Trusty OS.
3. The Trusty Root Key is the master key used to derive keys for various Trusted Apps like Keymaster, Gatekeeper etc.

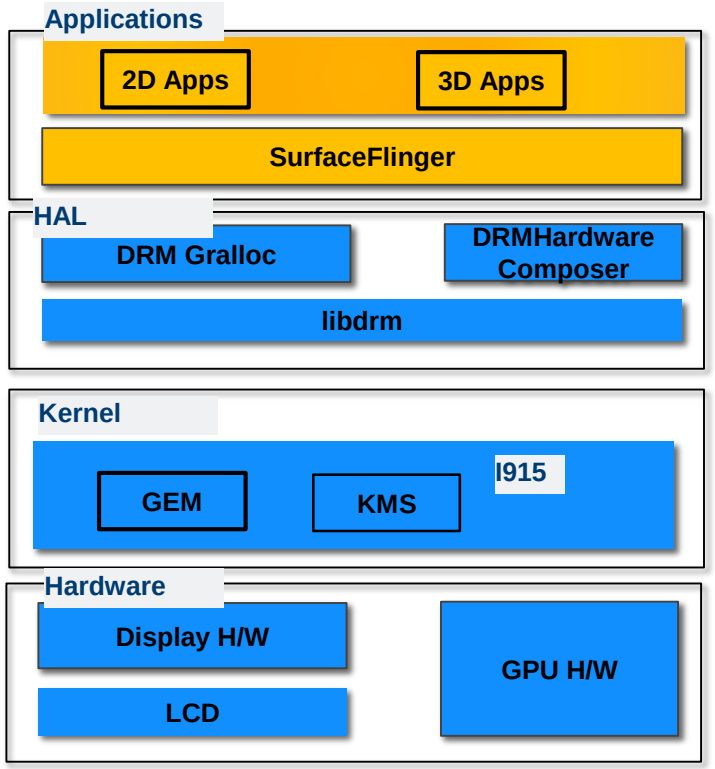


GOOGLE*

INTEL

GRAPHICS ON ANDROID THINGS* ON INTEL® JOULE™ MODULE

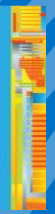
- 2D and 3D apps
- Buffered Views
- SurfaceFlinger
- Hardware Composer
- Open Source Graphics – Mesa*



GOOGLE*

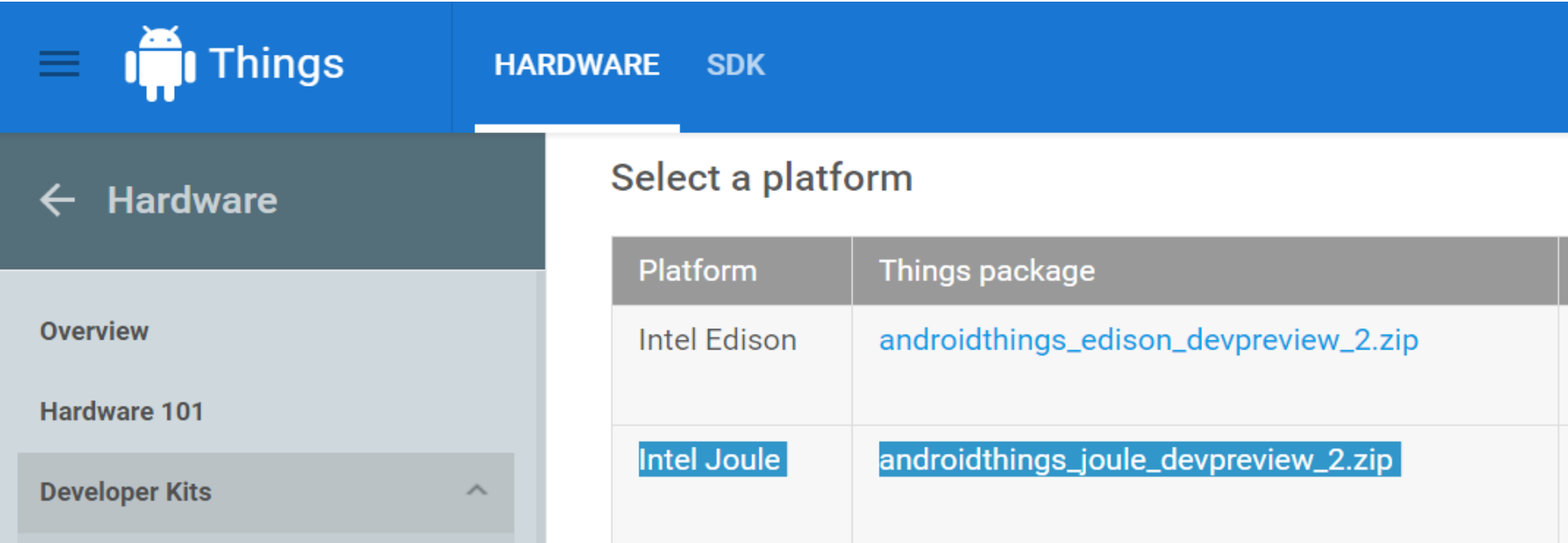
INTEL

Android Things* Getting Started



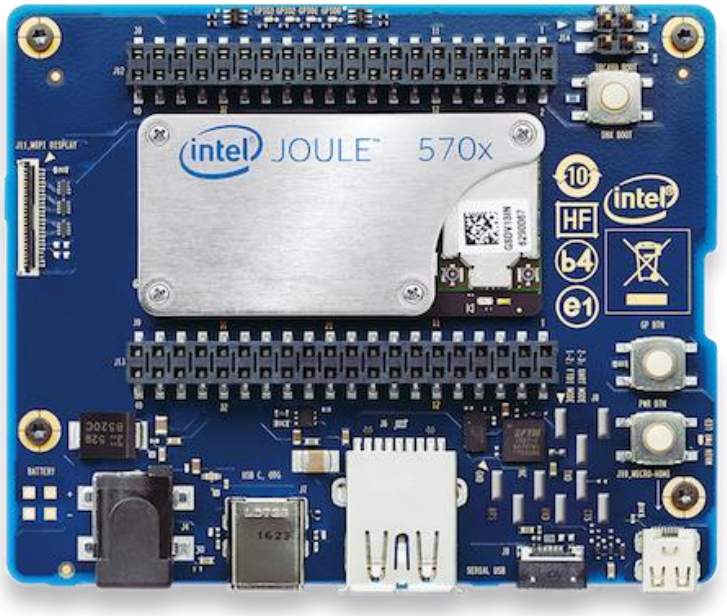
DOWNLOAD THE IMAGE

- https://developer.android.com/things/preview/download.html



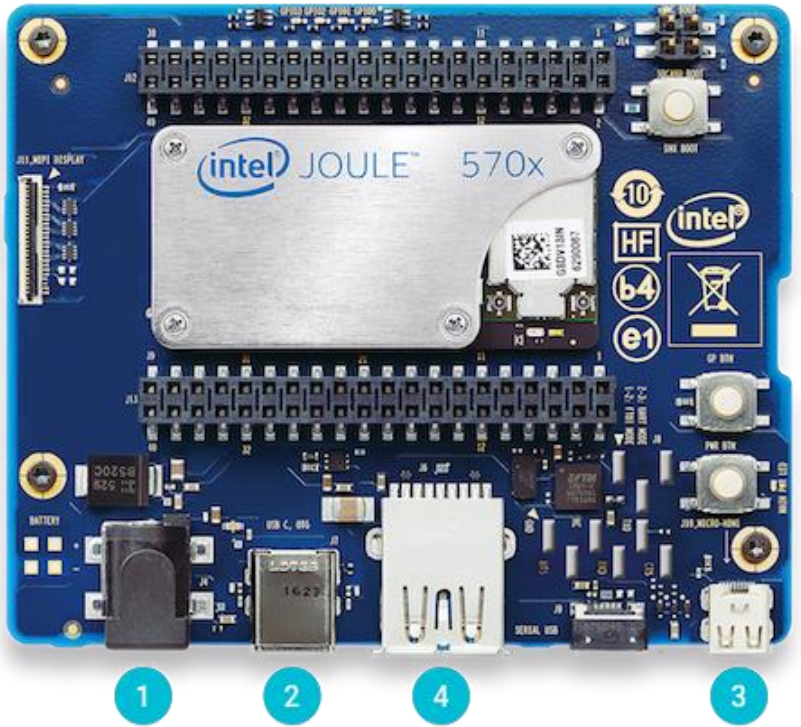
FLASHING THE IMAGE

- Micro-USB cable
- USB-C cable
- 12V 3A power adapter
- Micro-HDMI cable
- MicroSD card reader



FLASHING THE IMAGE

1. Connect a 12V adapter to the power input connector.
2. Connect a USB-C cable from your host computer for USB OTG.
3. Connect a Micro-HDMI cable to an external display.
4. Optionally, connect a USB keyboard for BIOS setup.



FLASH ANDROID THINGS*

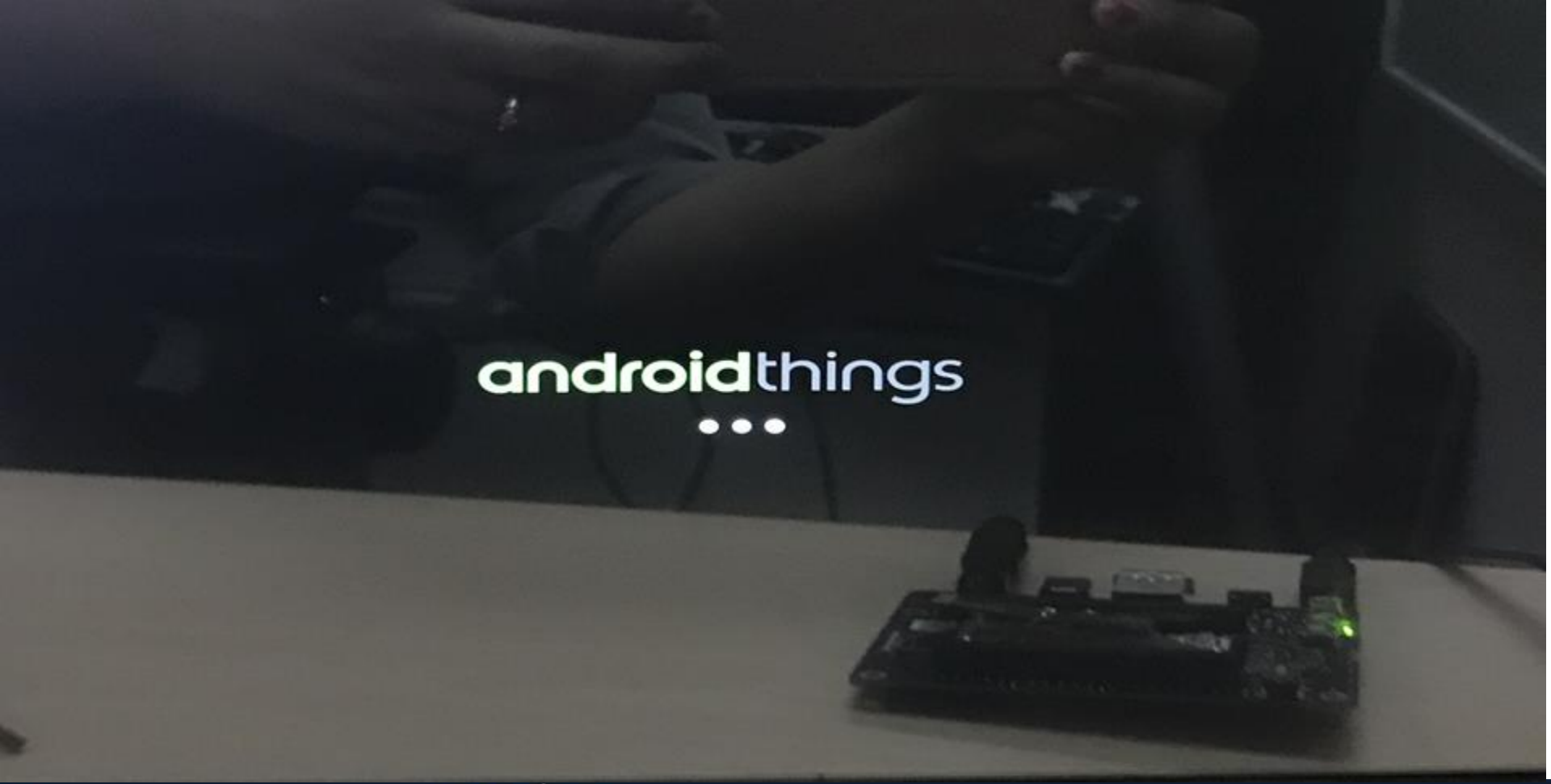
- Command Line
- Enter Fastboot mode

```
adb reboot bootloader
```

- Fastboot commands

```
$ fastboot \
    flash gpt partition-table.img \
    flash bootloader bootloader \
    erase misc \
    reboot bootloader

$ fastboot \
    flash gpt partition-table.img \
    flash oemvars oemvars.txt \
    flash bootloader bootloader \
    flash boot_a boot.img \
    flash boot_b boot.img \
    flash system_a system.img \
    flash system_b system.img \
    flash userdata userdata.img \
    flash gapps_a gapps.img \
    flash gapps_b gapps.img \
    erase misc \
    set_active _a \
    reboot
```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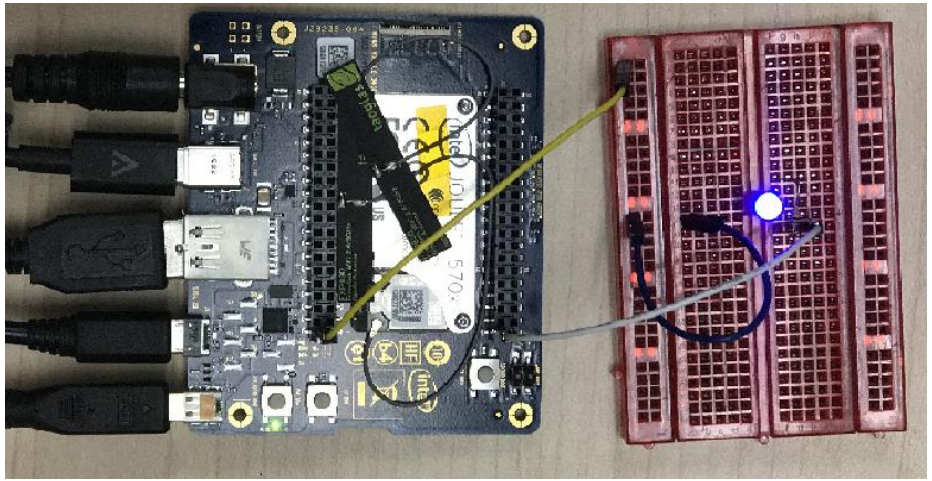
Android Things* Code Samples

BLINK LED EXAMPLE

- Sample Code from Google: SimplePIO Blink Application : Extended to Blink on-board LED on Intel® Joule™ module
- Download Android Studio – Android API level 7.0
- Clone the code and import to Android Studio

BLINK LED EXAMPLE

- GPIO 2 on J12 : PIO name “SPI_1_MISO”
- Blink Example :
  - 1 LED
  - 1 Resistor
  - 2 Jumper Wires
  - 1 Breadboard



BUILD AND INSTALL

- In Android Studio Press the Run to install the simplepio app
- Or use command line to install

```
./gradlew blink:installDebug
```

```
adb shell am start
com.example.androidthings.simplepio/.BlinkActivity
```

RESOURCES

Android Things on Intel Architecture: https://software.intel.com/iot/android-things

Android Things on Intel Edison: https://software.intel.com/iot/hardware/edison

Android Things on Intel Joule: https://software.intel.com/iot/hardware/joule

Getting Started guide : https://software.intel.com/iot/android-things#devguide

Google Android Things: https://developer.android.com/things/index.html

Forum & Support: https://g.co/iotdev

BACKUP

THE INTEL® EDISON KIT FOR ANDROID THINGS*

- The Intel® Edison kit with the Arduino* Expansion Board
- Intel is providing the board support package
- MANY sensors and devices are available for prototyping with this board
- Supported in Android Things since Dec ‘16.

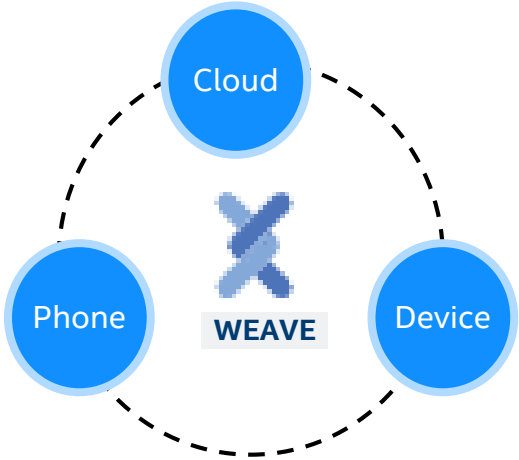
INTEL® EDISON BOARD FOR SPARKFUN*

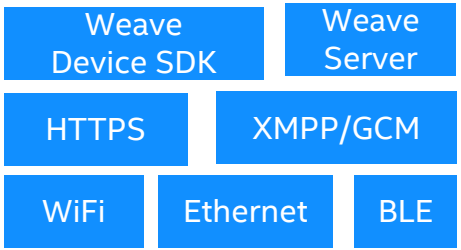
Compare to the Intel® Edison kit with Arudino:

- Same Edison CPU Module
- Simpler GPIO/Bus structure
- Stack on boards
- Smaller form factor
- Battery power available
- Many sensors available
- Supported in Android Things since Dec ‘16

WEAVE* V1

- Device setup, phone-to-device-to-cloud communication
- User interaction from mobile devices and the web
- Transports: 802.15.4 (zigbee, threads), BLE, WiFi, Ethernet





DISCLAIMER