

Running Android on the Raspberry Pi

Android Pie meets Raspberry Pi

Chris Simmonds

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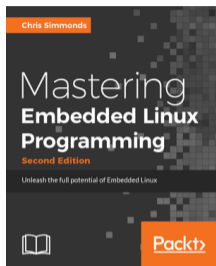
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About Chris Simmonds



- Consultant and trainer
- Author of *Mastering Embedded Linux Programming*
- Working with embedded Linux since 1999
- Android since 2009
- Speaker at many conferences and workshops

"Looking after the Inner Penguin" blog at <http://2net.co.uk/>



@2net_software



<https://uk.linkedin.com/in/chrisdsimmonds/>

Why?

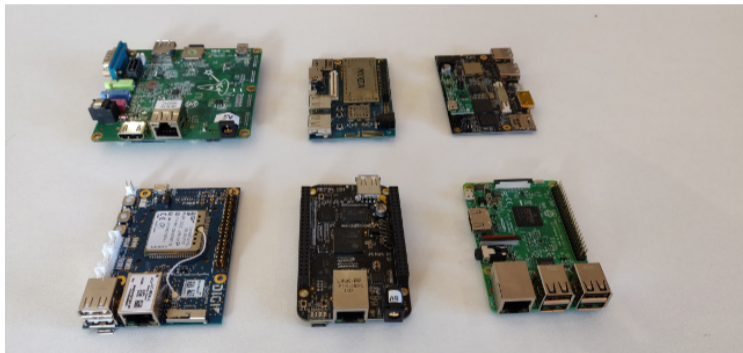
- Porting Android to a dev board is a great way to learn about Android
- It's a good testing ground for new ideas
- It's fun! No, really it is!

What do you need to run Android?

- Hardware from one of the supported architectures
 - ARM, x86 or MIPS, in 32 or 64 bit varieties
- Has a recent version of Linux kernel (v4.4 or later)
- At least 512 MiB RAM
- At least 1 GiB flash storage - e.g. eMMC, SD card
- Touchscreen or external display - e.g. HDMI
- GPU with OpenGL ES 2.0 libraries (more about this later)

Android on dev boards

DragonBoard, Hikey, BeagleBone, WandBoard, Raspberry Pi, Digi ConnectCore ...



Why Raspberry Pi?

- It's cheap
- Easy to get hold of
- Hackable
- **Because it is there**

Hasn't it been done already?

Sure! Here are some notable projects

- **Android RPi:** <https://github.com/android-rpi>
- **LineageOS:** (unofficial build from KonstaKang)
<https://konstakang.com/devices/rpi3/LineageOS15.1>
- **RTAndroid:** <https://embedded.rwth-aachen.de/doku.php?id=en:tools:rtandroid>
 - based on research by Igor Kalkov, now merged into emteria.os
- **emteria.os:** <https://emteria.com> (not open source)
- **Android Things:**
<https://developer.android.com/things/hardware/raspberrypi>
(not open source)

What do you need?

- A copy of the Android Open Source Project (AOSP)
- A Linux kernel with Android extensions
- A fair knowledge of the hardware
- All the help you can get from existing projects
- A fairly fast computer
- Time and patience

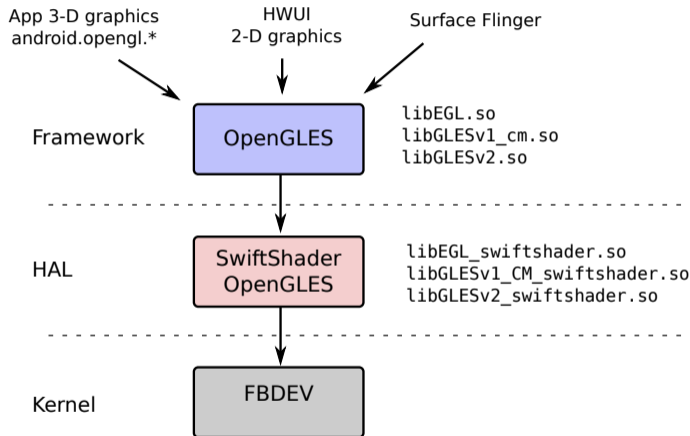
AOSP and RPi

- What follows is based on Konsta's port of LineageOS
- My version of the code is at <https://github.com/csimmonds/a4rpi-local-manifest>
- Challenges posed by the Raspberry Pi
 - Graphics
 - Lack of USB OTG port

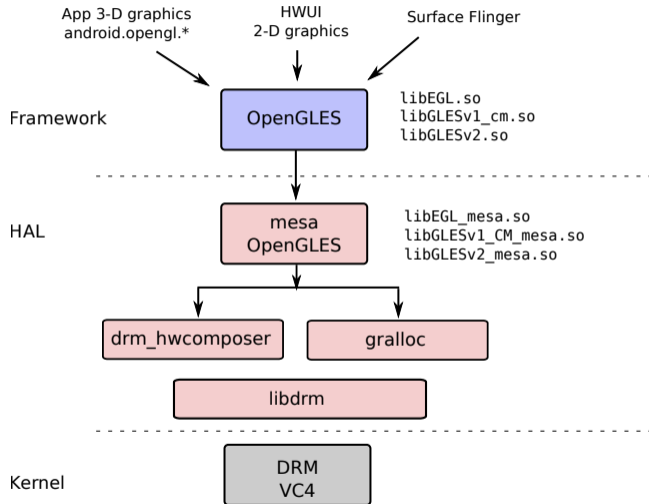
Graphics: OpenGL

- We need OpenGL ES 2.0 libraries **with Android extensions**
- Three options
 - Get a copy of the OpenGLES binaries from the vendor, if they exist (they don't for Broadcom BCM2708/2835)
 - Use Soft GPU, **Swiftshader**
 - Use Mesa and `drm_hwcomposer`

Graphics: Swiftshader



Graphics: Mesa3d



ADB

- Raspberry Pi only has USB host ports, but ADB needs a USB peripheral port
 - Usually provided by a dual mode USB "On The Go" (OTG) port
 - (Actually, the BCM283x has OTG hardware but it is used internally to bridge the USB host controller, Ethernet, and so on)
- But, we can use ADB over Ethernet instead

```
$ adb connect Android.local
connected to Android.local:5555
$
$ adb shell
rpi3:/ #
```

Current status

- Code for **Android for Raspberry Pi** is at <https://github.com/csimmonds/a4rpi-local-manifest>
- Android Pie 9.0 r 30
- Using Swiftshader
- Early stages: still many things to do



Delving deeper

- If you would like to discover more about building Android platforms, visit <http://www.2net.co.uk/training.html> and enquire about training classes for your company
 - 2net training is available world-wide

Relevant links:

Android 4 RPi

<https://github.com/csimmonds/a4rpi-local-manifest>

My web site

<http://www.2net.co.uk>

Any questions?