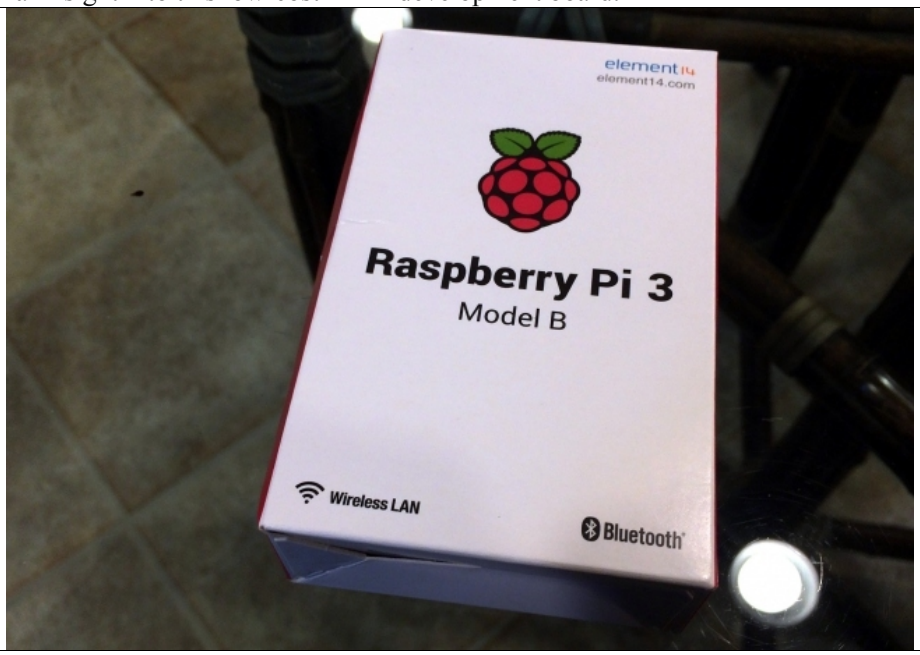
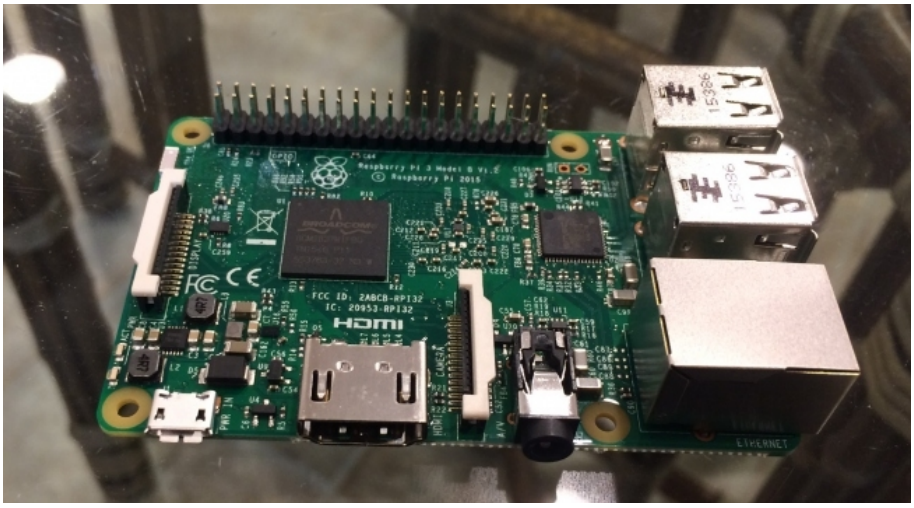
Raspberry Pi 3 Benchmarks vs. Eight Other ARM Linux Boards

Written by Michael Larabel in Computers on 5 March 2016. **Page 1 of 6**. 45 Comments

On Friday my Raspberry Pi 3 arrived for benchmarking. For our first benchmarks of this Cortex-A53 64-bit ARM $35 development board is a comparison against eight other ARMv7 and ARMv8 development boards running their official Linux distributions while carrying out a range of benchmarks. Here are those raw performance results along with a performance-per-dollar comparison for additional insight into this low-cost ARM development board.



For those that were out of it this week, the Raspberry Pi 3 Model B is still a $35 board and it features a 1.2GHz 64-bit quad-core (Cortex-A53) ARMv8 processor, 802.11n WiFi, Bluetooth 4.1, Bluetooth Low-Energy (LE), 1GB of LPDDR2 RAM, and the same VideoCore IV graphics as the earlier Raspberry Pi. The Raspberry Pi 3 has the same form factor as the earlier Raspberry Pi 2 and Raspberry Pi 1 Model B+ boards. Other similarities with the older boards (aside from the Pi Zero) are four USB ports, 40 GPIO pins, HDMI, Ethernet (via USB still, sadly), micro-SD card slot, camera interface, display interface, and other connectivity.



The Raspberry Pi 3 availability at launch appears to have been better than the Pi Zero and some previous launches. I was able to order this Raspberry Pi 3 on launch day and while writing this article on Saturday there still are some resellers with the RPi3 in-stock.

For getting an idea of the Raspberry Pi 3 performance potential, I compared the performance to the ARM boards used in the recent 8-Way ARM Board Linux Benchmark Comparison From The Pi Zero & ODROID To Tegra made possible by Lover Pi. The comparison targets included the Raspberry Pi 2 Model B, Raspberry Pi Zero, Banana Pi M2, ODROID C1 Plus, Orange Pi PC, Orange Pi Plus, NVIDIA Jetson TK1, and NVIDIA Jetson TX1. The quick specs on those other ARM boards include:

- **Raspberry Pi 2:** Quad-Core 900MHz Cortex-A7, 1GB RAM, VideoCore IV 3D, and sells for around $35+.
- **Raspberry Pi Zero:** ARMv6 single-core at 1GHz, 512MB of RAM, retails for $5+ when you can find them in stock.
- **Orange Pi Plus:** Allwinner H3 with quad-core Cortex-A7 1.6GHz and 1GB of RAM.
- **Orange Pi PC:** Allwinner H3 with Cortex-A7 quad-core with 1GB of RAM.
- **Banana Pi M2:** Allwinner A31S SoC with quad-core Cortex-A7 design at 1GHz and 1GB of RAM.
- **ODROID C1 Plus:** Quad-Core Cortex-A5 1.5GHz processor on the AMlogic S805 with 1GB DDR3 RAM.
- **Jetson TK1:** The Jetson TK1 is powered by the Tegra K1 SoC with a 4-Plus-1 quad-core design powered by ARM Cortex-A15 cores, 2GB of RAM, and Kepler graphics.
- **Jetson TX1:** NVIDIA's latest high-performance development board... The Jetson TX1 packs in a Tegra X1 SoC sporting four Cortex-A57 cores, Maxwell GPU, and 4GB of LPDDR4 memory.

Raspberry Pi 3, ODROID-C2 and Pine A64+ Development Boards Comparison

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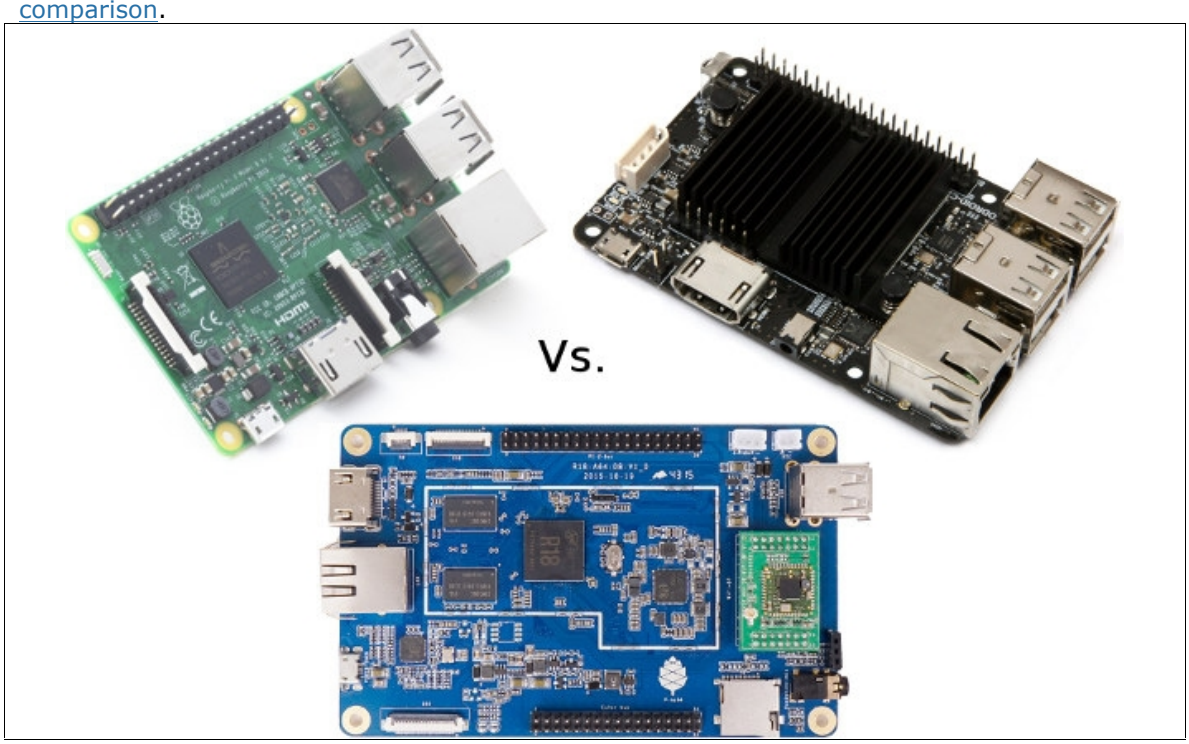
Raspberry Pi 3 and hardkernel ODROID-C2 launched the same day, and together with Pine A64/A64+, are the only ultra low cost (<$40) 64-bit ARM development boards available or soon-to-be available, so I've decided to make a comparison of the three boards the same way I did with ~$10 boards with a Raspberry Pi Zero, C.H.I.P, and Orange Pi One comparison.



I've used features of Pine A64+ instead of Pine A64 since features and price are closer to the other two boards. Text highlighted in green means a board is clearly better than the other two for a given features, while a red highlight means it's the weakest of the three.

	Raspberry Pi 3	ODROID-C2	Pine A64 Plus
Processor	Broadcom BCM2837 quad core Cortex A53 processor @ 1.2 GHz(4x ~2760 DMIPS)	Amlogic S905 quad core Cortex A53 processor @ 2.0 GHz(4x ~4600 DMIPS)	Allwinner A64 quad core Cortex A53 processor @ 1.2 GHz (4x ~2760 DMIPS)
GPU	VideoCore IV @ 300/400 MHz	Penta core (3+2) ARM Mali-450	ARM Mali-400MP2
Video Decoding	1080p30 for H.264, MPEG2* and VC1* * Extra licenses required	8-/10-bit H.265 up to 4K @ 60fps, H.264 up to 4K @ 30 fps, H.263, VC1, Mpeg1/2, AVS, Realvideo up to 1080p60	H.265/HEVC @ up to 4K @ 30 fps, H.264, VP8, AVS/AVS+ & MPEG1/2/2 @ 1080p60 , VC1 and MJPEG up to 1080p @ 30 fps

	Raspberry Pi 3	ODROID-C2	Pine A64 Plus
Video Encoding	Full HD H.264 video encoding	H.264 up to 1080p @ 60fps	H.264 up to 1080p @ 60fps
RAM	1GB LPDDR2	2GB DDR3	1 or 2GB DDR3
Storage	micro SD card slot	micro SD card slot + eMMC socket	micro SD card slot
Boot media	micro SD card slot, USB or PXE (network boot)	micro SD card slot or eMMC socket	micro SD card slot
Ethernet	10/100M Ethernet via USB bridge	Gigabit Ethernet	Gigabit Ethernet
Wireless Connectivity	WiFi 802.11 b/g/n (2.4GHz) and Bluetooth 4.1 LE	No, requires USB dongle	Not included by default, but an optional WiFi 802.11 b/g/n & Bluetooth module can be added
USB	4x USB 2.0 host ports + 1x micro USB port for power only	4x USB 2.0 host ports + micro USB OTG port	2x USB 2.0 host ports
Video	HDMI 1.4 with CEC and 3.5mm composite video jack	HDMI 2.0 with CEC Composite video can be added via unpopulated 2-pin header	HDMI 1.4
Audio	HDMI and 3.5 mm audio jack (Shared with composite video)	HDMI	HDMI, 3.5mm audio jack
I/Os and other peripherals	40-pin header with 26 –GPIOs, 1x UART (debugging), 1x SPI, 2x I2C, PCM/I2S, 2x PWM CSI (camera serial interface) DSI (display serial interface).	40-pin header with GPIO, I2C, UART, PWM, 1-wire, and ADC 7-pin I2S for audio Built-in IR receiver	40-pin Raspberry Pi 2 compatible header with up to 27x GPIOs, 1x I2C, 1x SPI, 1x UART. 34-pin “Euler” header with IR, I2S, 1x SPI, 2x UART, S/PDIF 4-lane MIPI DSI connector and touch panel connector MIPI CSI camera interface
Power	5V via micro USB Idle power consumption: With UI (Raspbian?): 0.31A @ ~5V Terminal only: 0.22A @ 5.19 V	5V via micro USB OTG port or power barrel Idle power consumption: TBD	5V via power barrel or 3.7V LiPo battery Idle power consumption: TBD
Dimensions	85 x 56 mm	85 x 56mm	127mm x 79mm

	Raspberry Pi 3	ODROID-C2	Pine A64 Plus
Linux Support	Official: Raspbian with recent Linux 4.x kernel. Many other community supported distros including OpenELEC, OSMC, Ubuntu Matte, Ubuntu Snappy Core, etc… 32-bit user space only (currently) Mainline Linux support in progress.	Official: Ubuntu 16.04 32-bit and 64-bit images with Linux 3.14 kernel Amlogic S905 Mainline Linux support in progress(but likely preliminary)	Community: Ubuntu 16.0464-bit with Kernel 3.10 (No GPU and VPU support) Mainline support in progress.
Android Support	No (at least not a usable version)	Android 5.1	Android 5.1
Windows 10 IoT Support	Yes	No	Not yet, but maybe later
Community	Largest community so far for a development board on Raspberry Pi Forums. Monthly MagPi magazine	Active community onODROID forums Monthly ODROID magazine	Somewhat active Pine64 Forum, but frequency of post should increase once many of the 36,781 Kickstarter backers receive their board
Documentation, and hardware files.	Documentation is available via eLinux RPI Wiki, with little info about Raspberru Pi 3 specifically, but it's not really an issue, as it's software compatible with Raspberry Pi 2 Schematics are not available, even in PDF format, and the board hardware is closed source. Broadcom BCM2837 datasheet is not available, however many of the peripherals will be similar to BCM2835 where the datasheet has been released.	Documentation can be found on ODROID-C2 Wiki. Schematics (PDF), autocad files, and Amlogic S905 datasheet are not available (yet), but those files were provided for ODROID-C1. No PCB layout or Gerber files are provided for ODROID boards, so the board is also closed source.	Documentation is available onPine64 Wiki. Schematics (PDF), and datasheet for all main chips including Allwinner A64 datasheet have been released. PCB layout and Gerber files are not available, which makes the board closed source.
Listed Price	$35	$40	$19 (1GB RAM) / $29 (2GB RAM) Kickstarter prices
Shipping to US address	$7.99 via MCM Electronics Total: $42.99	$6.75 on Ameridroid. Total: $48.70 (Board price is $41.95)	$7 Total: $26 or $36

	Raspberry Pi 3	ODROID-C2	Pine A64 Plus
Distribution network and Availability	Wide sales network, with most online retailers and some brick and mortar shops selling Raspberry Pi boards. Good availability as the foundation produces 300,000 boards before launch	Available via Hardkernel, or distributors in US and Europe. Shipping may be costly to some other countries.	Currently not available, and it's not clear which distributions channels will be used. Kickstarter backer s are starting to receive their boards.

Since there's quite a lot to go through, I may have made some mistakes, or missed some little known features, and corrections are welcome in the comments section. Please note that the prices for Pine A64 is likely to go up a little after the Kickstarter campaign.

Boards are likely to show similar performance in synthetic benchmark, except ODROID-C2 which should show a significant lead. However, I could not find benchmark for Pine A64 right now, and as we've seen this morning, Aarch64 improves performance significantly over Aarch32, so current benchmarks are likely to become invalid if/once Raspberry Pi 3 gets a 64-bit port. For example, Pine A64 is currently 15 times faster in sysbench CPU benchmark (prime numner computation) compared to Raspberry Pi 3, and it's clearly not showing the true performance difference.

As usual there's no board that is always better than the other two, and depending on your use case, technical ability, and other factors, one board may be better suited to you or your application.

Read more: http://www.cnx-software.com/2016/03/01/raspberry-pi-3-odroid-c2-and-pine-a64-development-boards-comparison/#ixzz46vUdgHOc