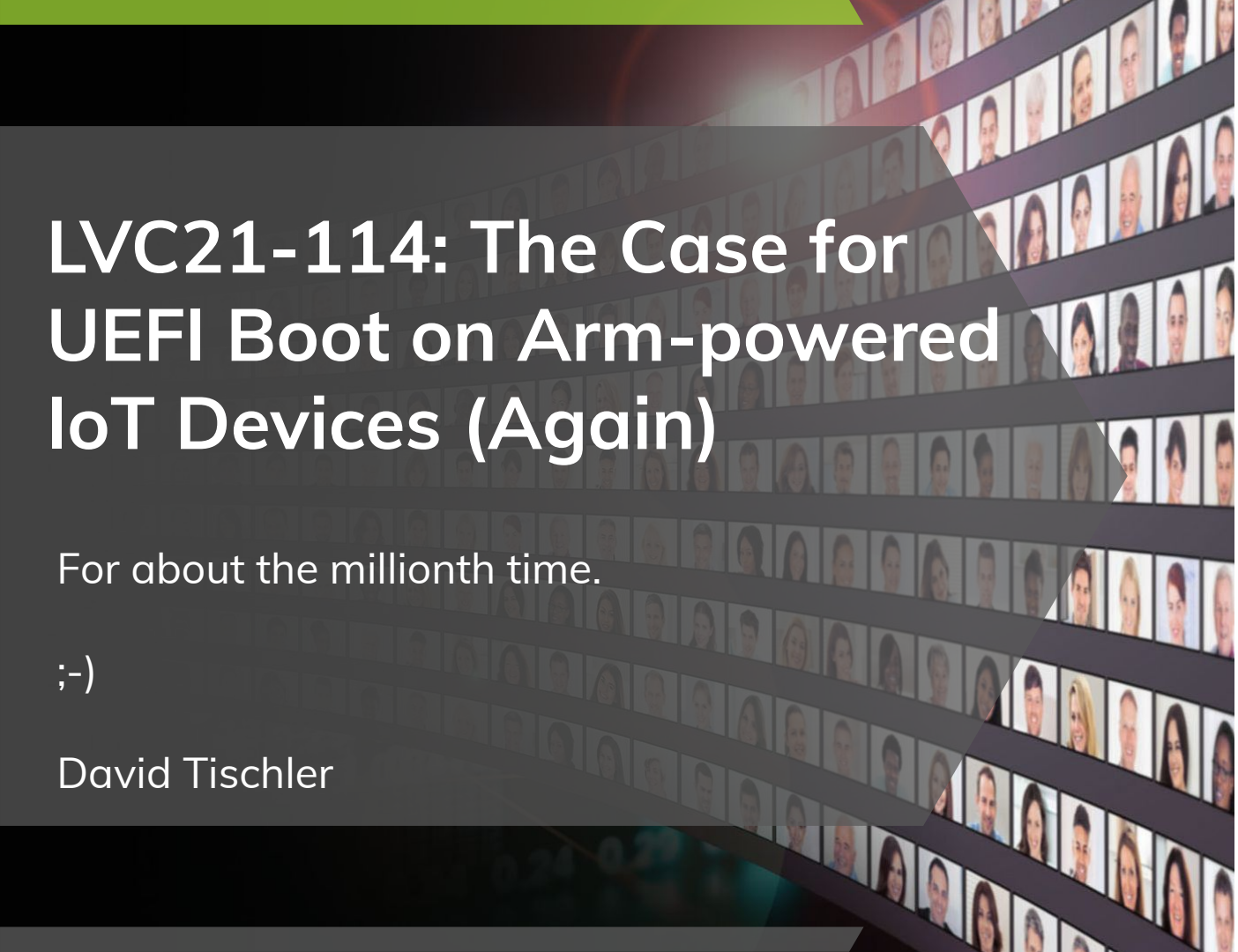


LVC21-114: The Case for UEFI Boot on Arm-powered IoT Devices (Again)

For about the millionth time.

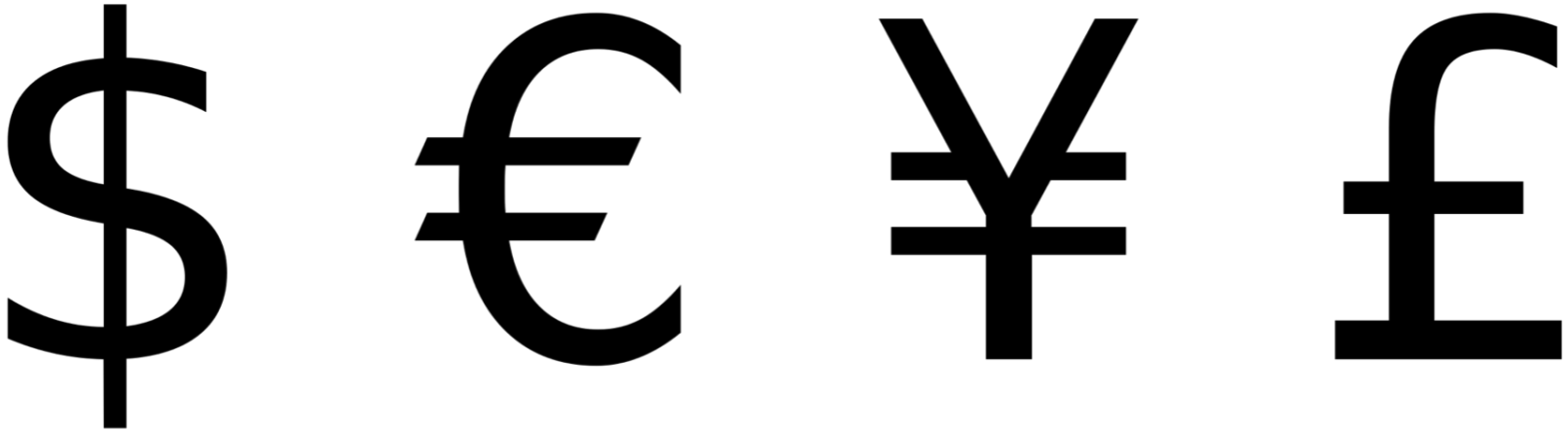
;-)

David Tischler

Linaro Connect
VIRTUAL • SPRING 2021

Yet Another Take on Why Standards Matter

Warning: This is not a technical talk, its a story about attempting to bring up a Yocto-based OS on an Arm IoT device. Oh, and:



Buzzword Bingo

But first, let’s talk about the 5G and Edge Computing revolution (that will of course be powered by the quantum hyperscale blockchain AI running on distributed serverless multicloud K8S).

Feel free to insert any buzzwords I may have missed...

But seriously, IoT and Edge Computing is everywhere

My $dayjob is at an IoT Fleet Management platform, balena.io

We support ~60 Arm device types, including all of the various Pi's, Jetsons, Beagles, and more enterprise-focused boards from Variscite, CTI, Compulab, etc.

We build our own Yocto-based OS, with a container engine and VPN link

Which actually means we have to build ~60 unique OS'es, with differing bootloaders and boot partitions and alignment. (Spoiler alert: this is not scalable)

We build **two** x86 images: NUC, and generic x86-64.

But seriously, IoT and Edge Computing is everywhere

AIO 3288C	BalenaOS 2.38.3+rev10	armv7hf	Production	Development
Aetina N310 TX2	BalenaOS 2.56.0+rev4	aarch64	Production	Development
Aetina N510 TX2	BalenaOS 2.56.0+rev4	aarch64	Production	Development
Asus Tinker Board	BalenaOS 2.38.3+rev1	armv7hf	Production	Development
Asus Tinker Board S	BalenaOS 2.38.3+rev1	armv7hf	Production	Development
Auvidea JN30B Nano	BalenaOS 2.67.3+rev2	aarch64	Production	Development
Balena Fin (CM3)	BalenaOS 2.72.0+rev1	armv7hf	Production	Development
BananaPi-M1+	BalenaOS 2.12.7+rev4	armv7hf	Production	Development
BeagleBoard-XM	BalenaOS 2.38.0+rev1	armv7hf	Production	Development
BeagleBone Black	BalenaOS 2.73.1+rev2	armv7hf	Production	Development
BeagleBone Green	BalenaOS 2.58.3+rev1	armv7hf	Production	Development
BeagleBone Green Gateway	BalenaOS 2.67.3+rev1	armv7hf	Production	Development
BeagleBone Green Wireless	BalenaOS 2.51.1+rev2	armv7hf	Production	Development
CTI Astro TX2 G+	BalenaOS 2.56.0+rev4	aarch64	Production	Development
CTI Orbitty TX2	BalenaOS 2.51.1+rev4	aarch64	Production	Development

You Are All Engineers

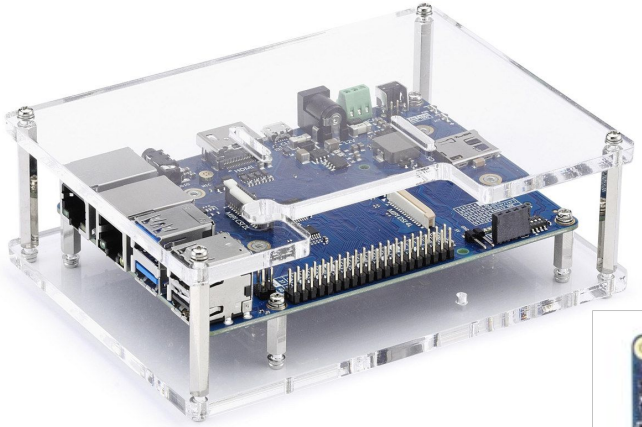
...and u-boot, device tree, bootloader, kernel and board enablement experts. But the other 99.999% of the world is not. So what happens when “regular” business users and IT departments want to begin participating in this Edge Computing revolution?

Let’s find out!

Let’s Perform an Experiment

I have an I-Pi SMARC PX30:

- Rockchip PX30
- 2gb RAM
- 2x LAN
- USB 3.0
- CANBUS

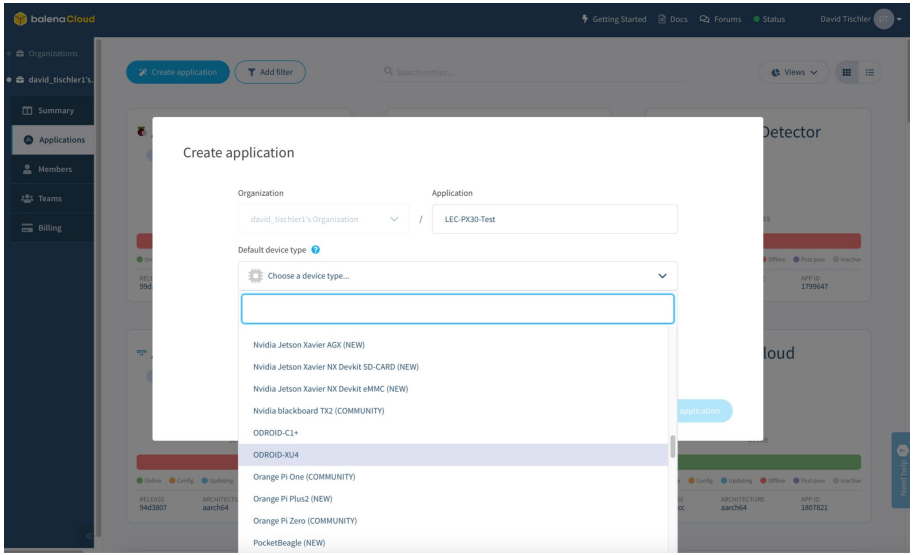


Now I want to boot balenaOS, so that I can control the board using the native cloud platform

I Am Not An Engineer

I just want to run this OS. This shouldn't be complicated. Just flash something to a USB stick and boot, right?

Wrong.



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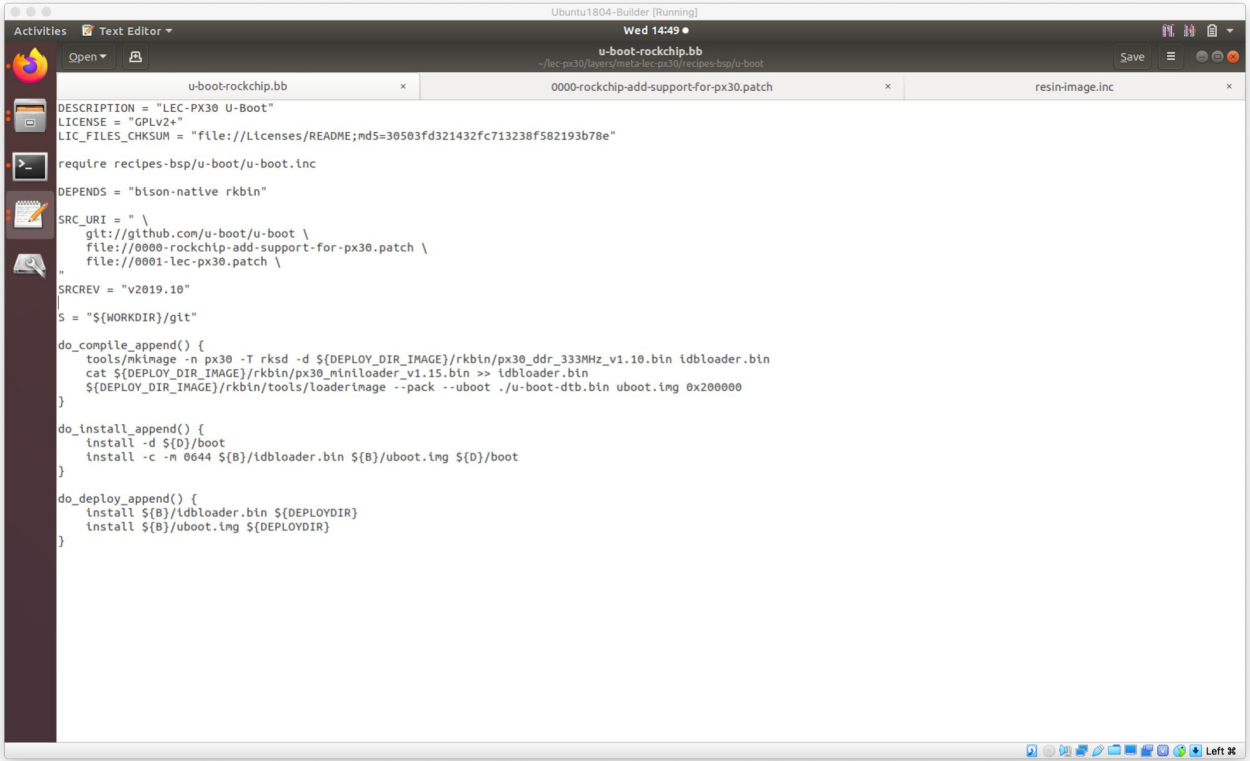

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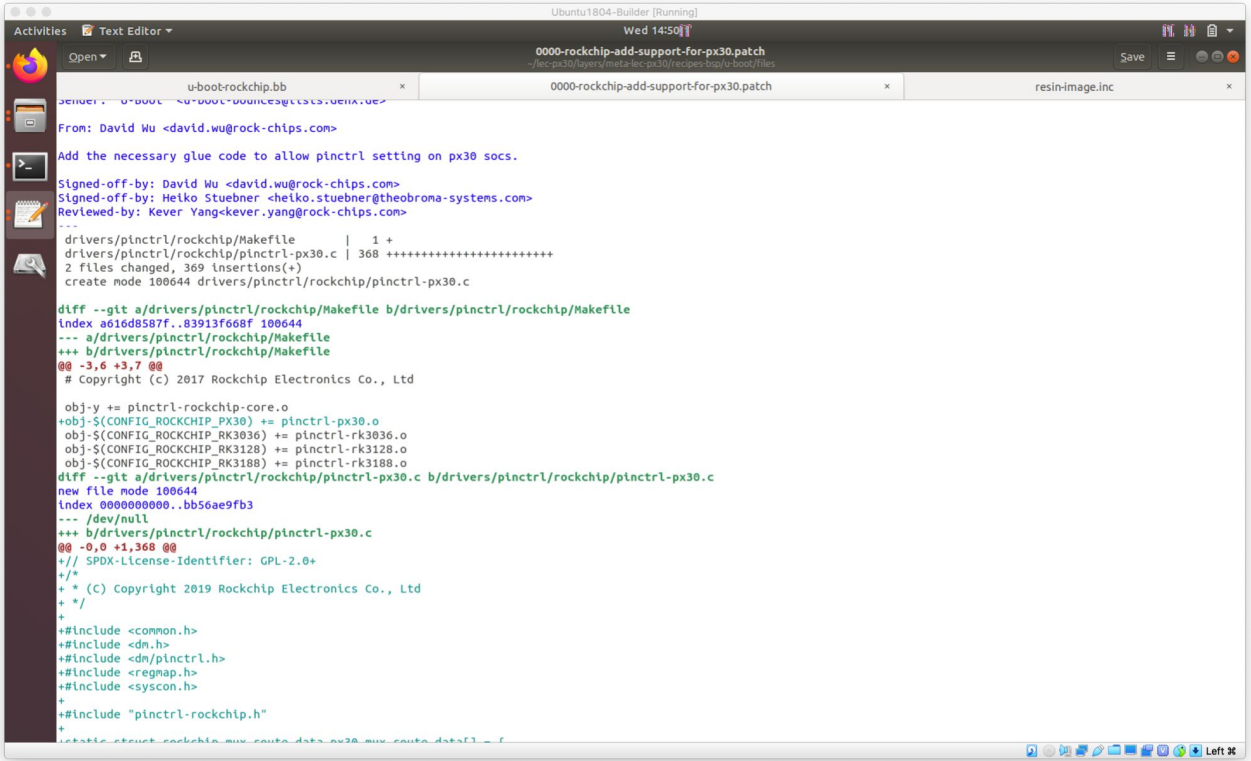

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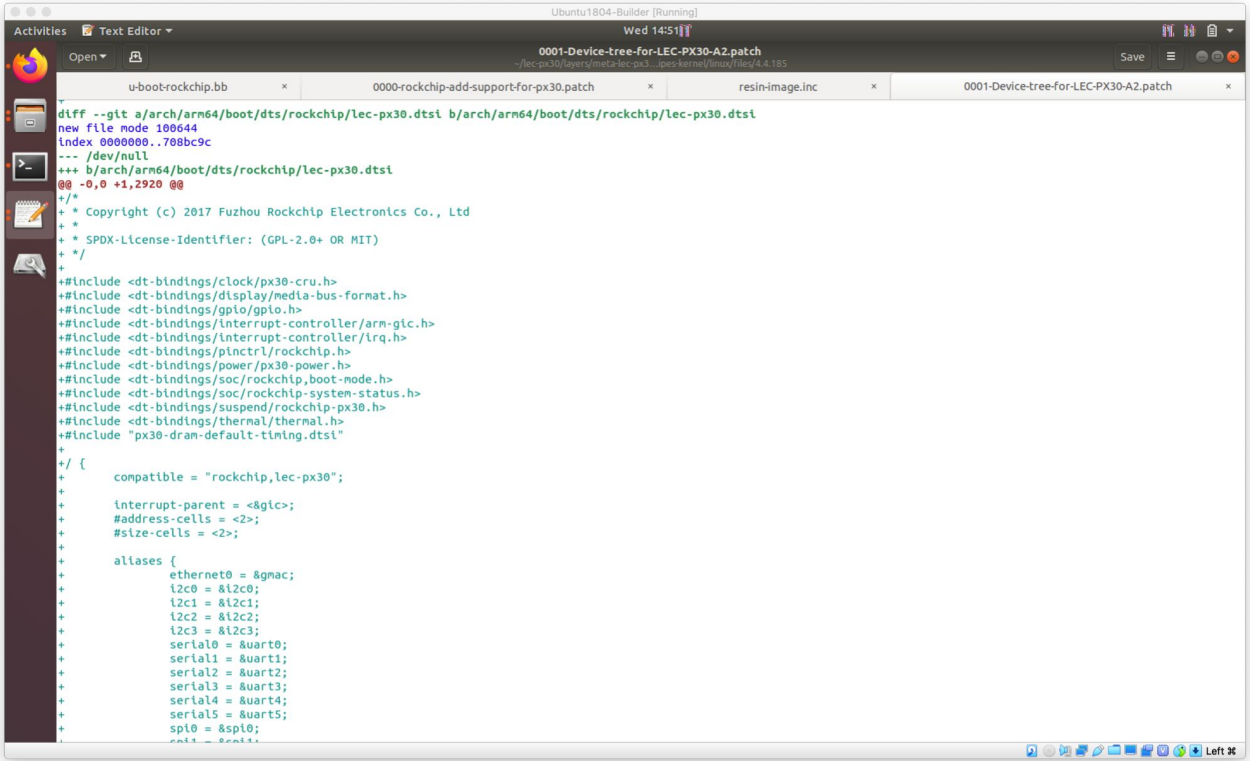

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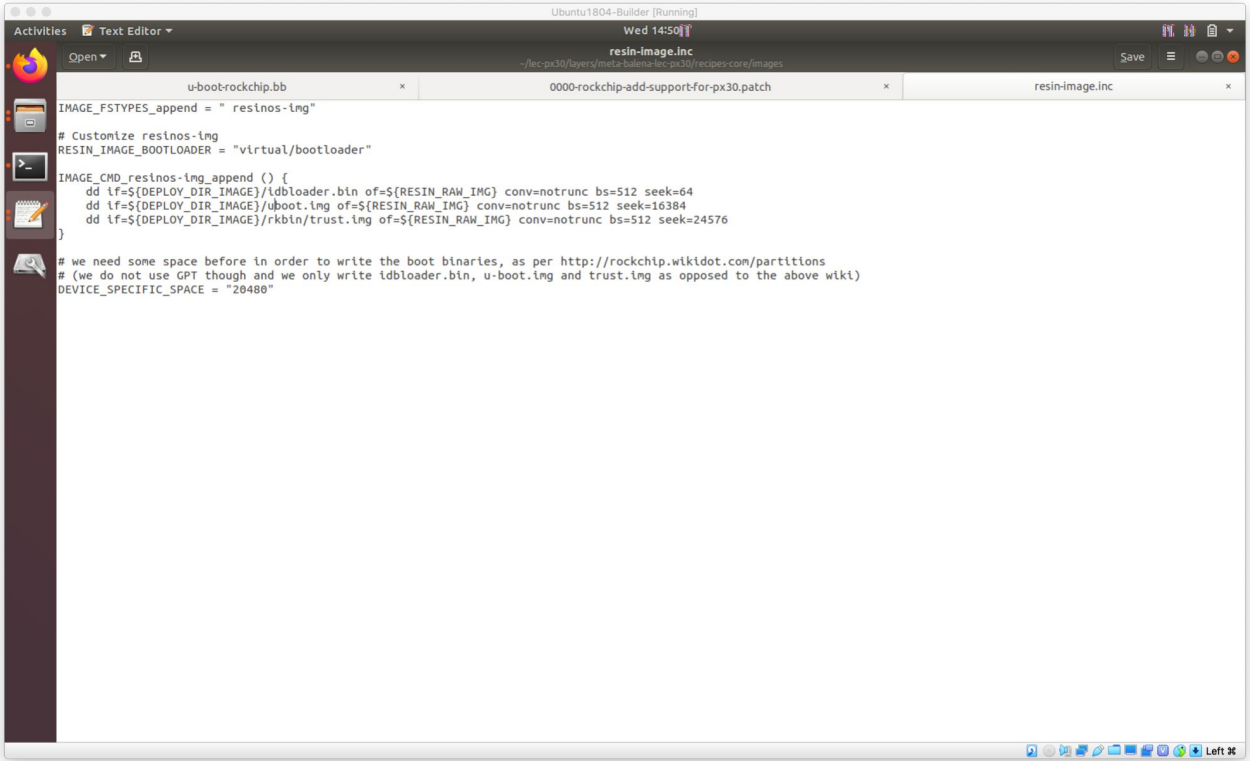
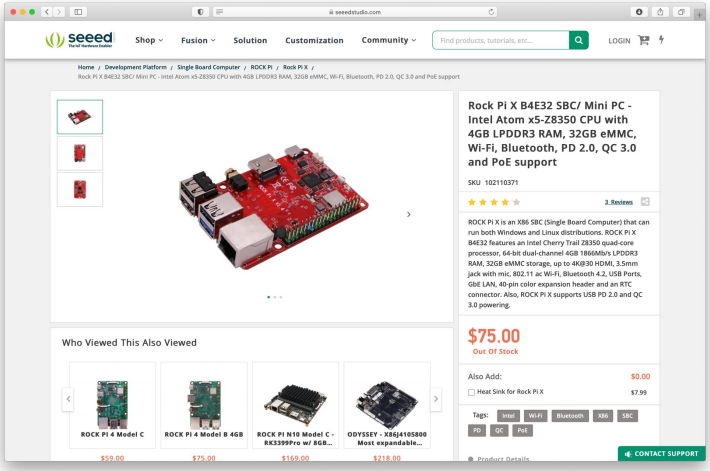


End Result?

It took me 6 months of reading, research, learning, and “side project” on/off work to boot this board and successfully run my OS of choice. This is not feasible.

So out of curiosity, I wonder how hard it is to boot an x86 board? Are all IoT projects this painful?

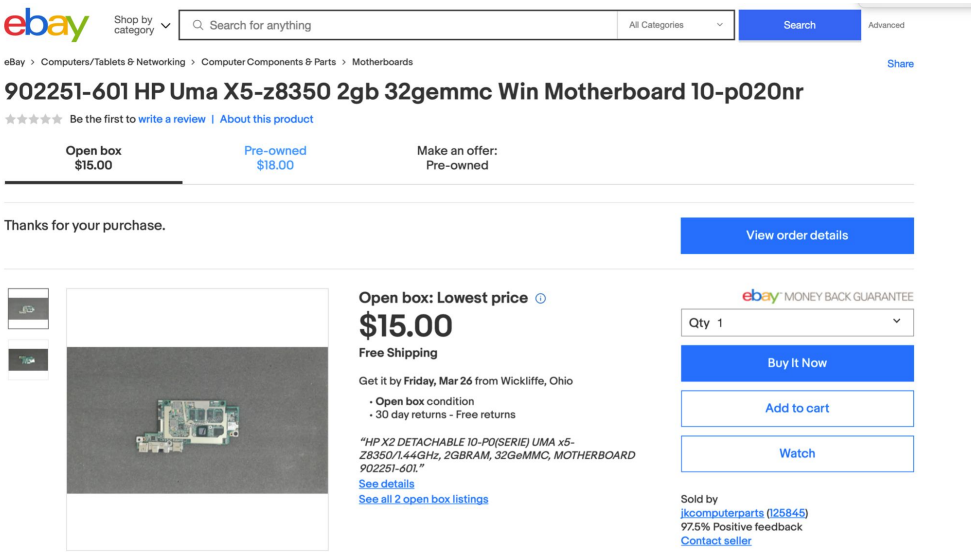
I have seen small x86 devices before, like this “Rock Pi X”:



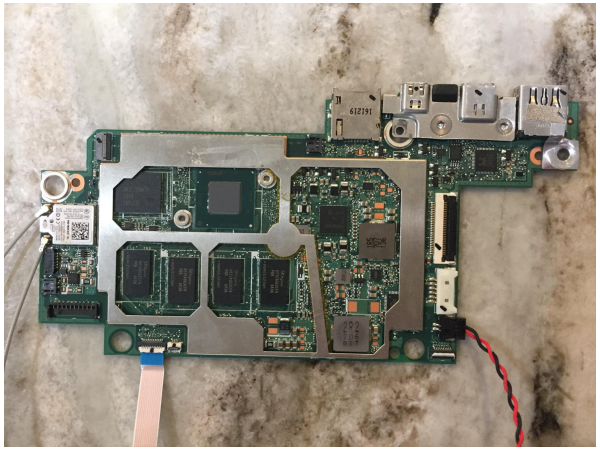
x86 Comparo

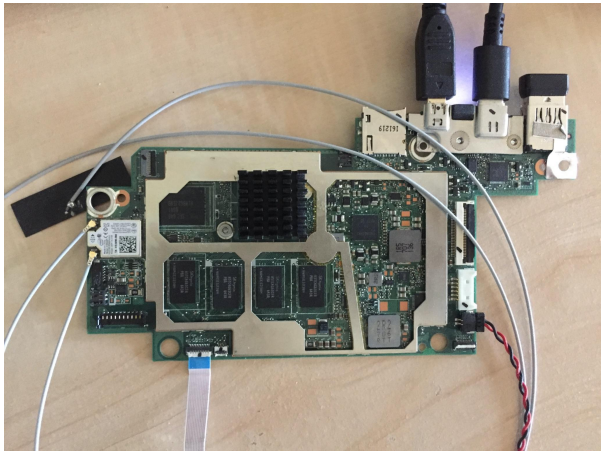
Hmmm, the “Rock Pi X” is Out of Stock, so let’s see what’s on ebay:

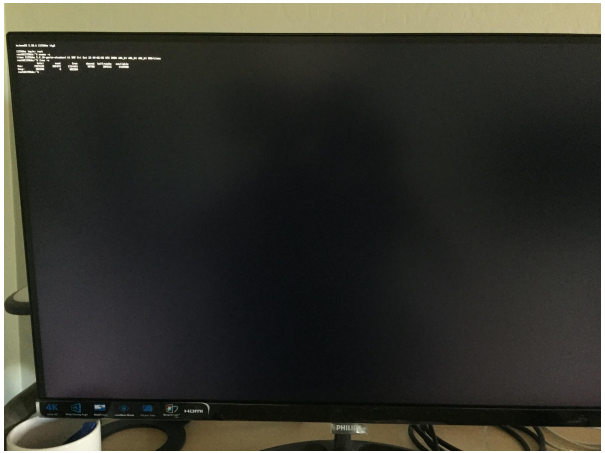
This is interesting, the same SoC, but originally in a 2-in-1 tablet laptop thing:



x86 Comparo



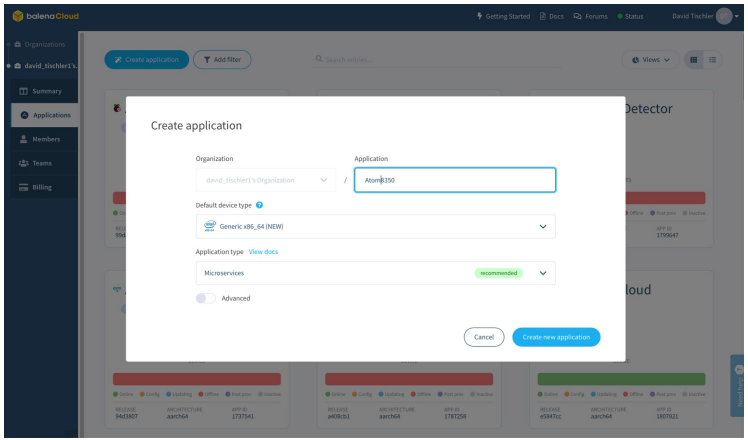


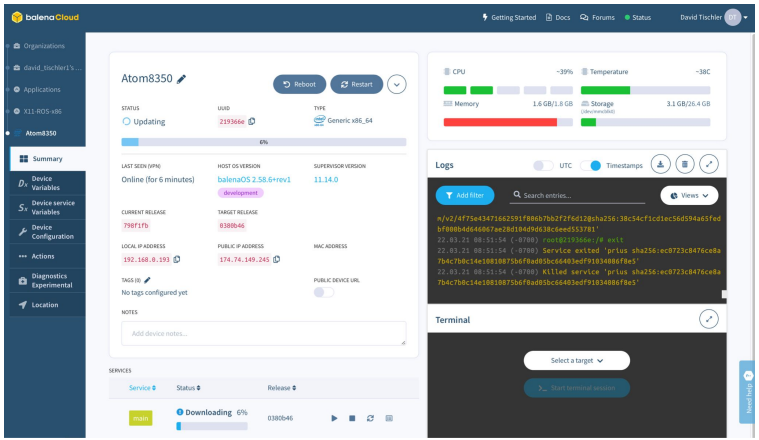


Final Results

It showed up in the mail, I plugged it in, entered UEFI, disabled Secure Boot, selected my USB stick to boot from, and it “Just Worked”.

Connected to balenaCloud, in approximately 12 minutes start to finish.





Prototype to Production for a Typical Customer

So after that exercise in frustration on the Arm device, an IT organization can then finally begin to build out their product, scale, and launch.

6 months behind schedule.

Or at the 4-month mark, they give up, and buy Intel NUC’s.

Time, Money

I promised we would talk about money.

Now, I performed this exercise part time, for 6 months, and am not a true subject matter expert.

So what would a company do? Hire an embedded engineer? That will add 100k (USD) to the budget for their project. Let their project timeline slip? Who is going to deliver that bad news to the executive team?

No, they will pivot to using x86 devices that “just boot”

The Future

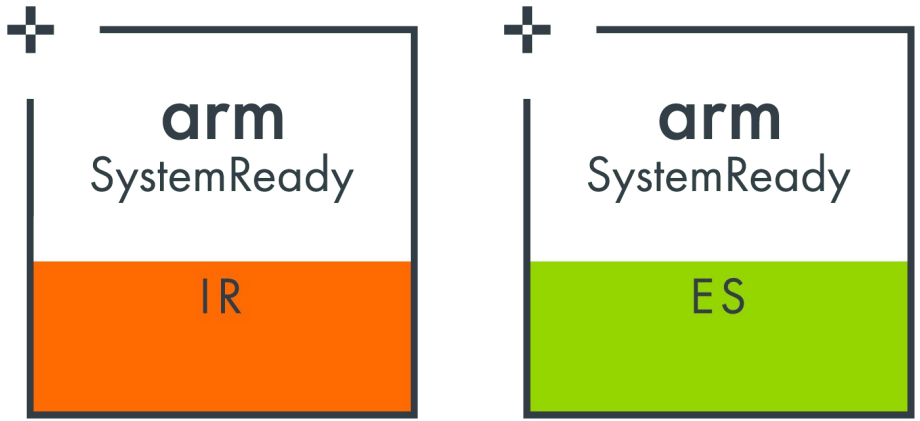
Let’s look into our crystal ball, and predict what happens in 5 to 10 years:

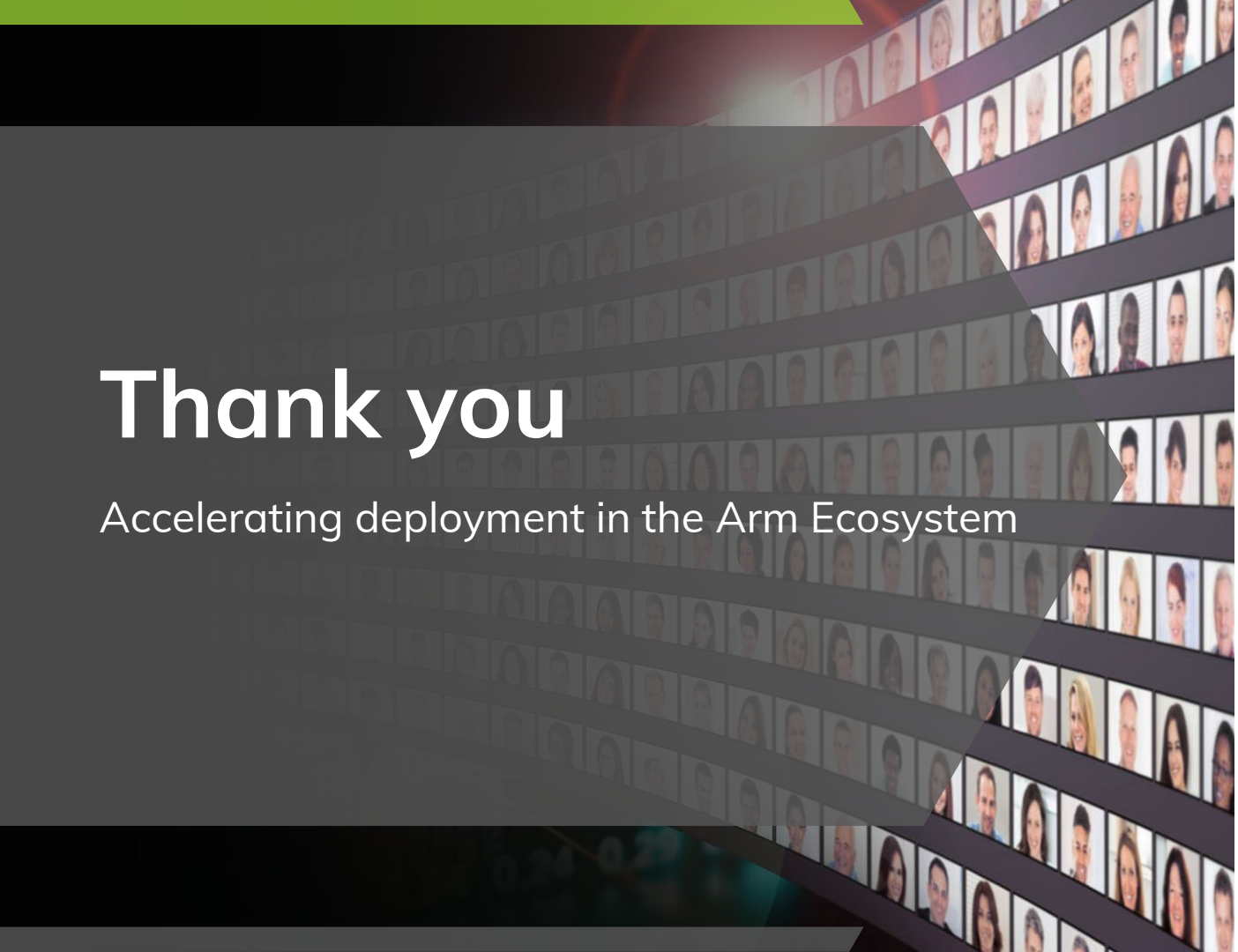
Arm loses the Edge Computing market, and x86 wins.

Because “regular businesses” want to participate in Edge computing, and they can’t.

The Ask

Board manufacturers, with the help of the SoC vendors if/as needed, produce developer boards that we know and love with UEFI, so we can just run any OS we want and not worry about learning all the things I had to learn.





Thank you

Accelerating deployment in the Arm Ecosystem

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