Raspberry Pi 3

Goal: Setting up a Raspberry Pi 3 for staking Spectrecoin 24/7

Reasons: Energy consumption (page 2-3)

Hardware:

- **Raspberry Pi 3 Model B**
  - https://www.amazon.de/gp/product/B01CD5VC92/ref=ox_sc_act_title_5?smid=A3JWKAKR8XB7XF&psc=1
- **iTrunk Raspberry Pi 3 power supply 5V 2.5A**
  - **Please read the power consumption part first.**
  - https://www.amazon.de/gp/product/B01MDUSBPV/ref=ox_sc_act_title_3?smid=AGC53QQDDOOWD&psc=1
- **SanDisk Ultra 32GB microSDHC**
  - You may also go with a smaller microSDHC card, any size above 4-8GB should do. But since I've no clue how big the Spectre blockchain will become, I choose 32GB. Please note that the card I suggest via link below comes with an adapter for SDHC card readers. You'll have to get one in case your SDHC card reader can't read microSDHC cards, which most don't. They just read the bigger form factor SDHC.
  - https://www.amazon.de/gp/product/B073S8LQSL/ref=ox_sc_act_title_2?smid=A3JWKAKR8XB7XF&psc=1
- **Intenso Micro Line 4 GB USB-Stick USB 2.0**
  - By using an usb stick as a swap partition, we get enough RAM memory to compile on the pi and save up as much of the lifetime of the microSDHC card. It's mainly due to the limited amount of writing cycles those cards can do. In fact you basically could use any old usb stick for this.
  - https://www.amazon.de/gp/product/B00372BC4G/ref=ox_sc_act_title_1?smid=A3JWKAKR8XB7XF&psc=1
- **Raspberry Pi 3 B + aluminium case**
  - The newer Raspberry Pi 3 model (referred to as Model B +) has a little metal cap build up on the cpu. The case is NOT compatible with that. The main reason for this case is the passive cooling ability.
  - https://www.amazon.de/gp/product/B0769TKLJQ/ref=ox_sc_act_title_4?smid=ALXSM2C1LM8H0&psc=1

Software:

- Raspbian stretch with desktop
  - https://www.raspberrypi.org/downloads/raspbian/

Requirements:

- Linux desktop pc/laptop
- SDHC card reader. In case you don't have any, you may take this one: https://www.amazon.de/gp/product/B009D79VH4/ref=ox_sc_act_title_1?smid=A3JWKAKR8XB7XF&psc=1
- Lan cable rj45 – just the standard cable

Plan:

Setting up the pi running rasbian stretch with desktop interface and using the usb-stick for swapping.

Costs

Hardware costs:

- Raspberry Pi 3 Model B - should be around 32€
- iTrunk Raspberry Pi 3 power supply 5V 2.5A - should be around 8€
- SanDisk Ultra 32GB microSDHC - should be around 11€
- Intenso Micro Line 4 GB USB-Stick USB 2.0 - should be around 6€
- Raspberry Pi 3 B + aluminium case - should be around 11€

Software cost:

None. All the software used is opensource.

We end up in total with approximately 68€. In case you want to save money leave out the case, take an old usb stick (any will do), take a smaller microSDHC card – this will result in 49€ total.

Power consumption

If you are interested in this topic note, that the actual consumption depends on:

- Disabling HDMI
- Disabling onboard LEDs

I'll use 260mA (1.4W) for idle and 730mA (3.7W) for 400% load (all cores at 100%) referring to the following source. You may get a deeper view here: https://www.pidramble.com/wiki/benchmarks/power-consumption

Keep in mind that the very most of the time staking the Raspberry Pi will be idle, therefore the following calculation will be a very lose upper bound. You must know that lossless energy transformation does not exist in electronics. One can find a very good article regarding to this topic here: https://electronics.stackexchange.com/questions/41938/230v-ac-to-5v-dc-converter-lossless

Assumptions for Raspberry Pi:

- 5% of the time the cpu will run at 400% load stress (all 4 cores at 100%)

$$\Rightarrow 95\% \cdot 8760\text{h} \cdot 1.4W + 5\% \cdot 8760\text{h} \cdot 3.7W \approx 11650.8Wh + 1620.6Wh \approx 13.271kWh/year$$

- You used a good power supply with at least 80% efficiency. Which means 80% of the total power consumption is delivered to the Raspberry Pi.

$$\Rightarrow (80\%)^{-1} \cdot 13.271kWh = \left(\frac{4}{5}\right)^{-1} \cdot 13.271kWh = \frac{5}{4} \cdot 13.271kWh \approx 16.589kWh/year$$

Result: **16.6kWh per year is the lose upper bound for the energy consumption of the Raspberry Pi 3.**

Now let's compare it to a very energy efficient ideal Laptop (Desktop would be even worse). We assume 7.5W at idle, 20W at load – these are extreme low values, assuming state of the art hardware and no display being used. Although we assume the laptop has a 90plus power supply.

Assumptions for a laptop:

- 1% of the time the cpu will run at full load stress (we assume the cpu is 5 times faster than the pi)

$$\Rightarrow 99\% \cdot 8760\text{h} \cdot 7.5W + 1\% \cdot 8760\text{h} \cdot 20W = 65043Wh + 1752Wh$$
$$= 66.795kWh/year$$

- You used a very good power supply with at least 90% efficiency.

$$\Rightarrow \frac{10}{9} \cdot 66.795kWh \approx 74.217kWh/year$$

Result: > 74kWh per year is the very idealistic upper bound for any(!) laptop solution. In fact, most hardware will perform even worse, so you should take this a value that can easily double, when using just an “old laptop”. Note this does not depend on the operation system.

Conclusion: The Raspberry Pi Solution will reduce the total energy consumption by at least 80%. It should be at least approximately **5 times more energy efficient** than every high-end laptop solution, which will cost at least 10 times more than the whole hardware bundle for the Pi.