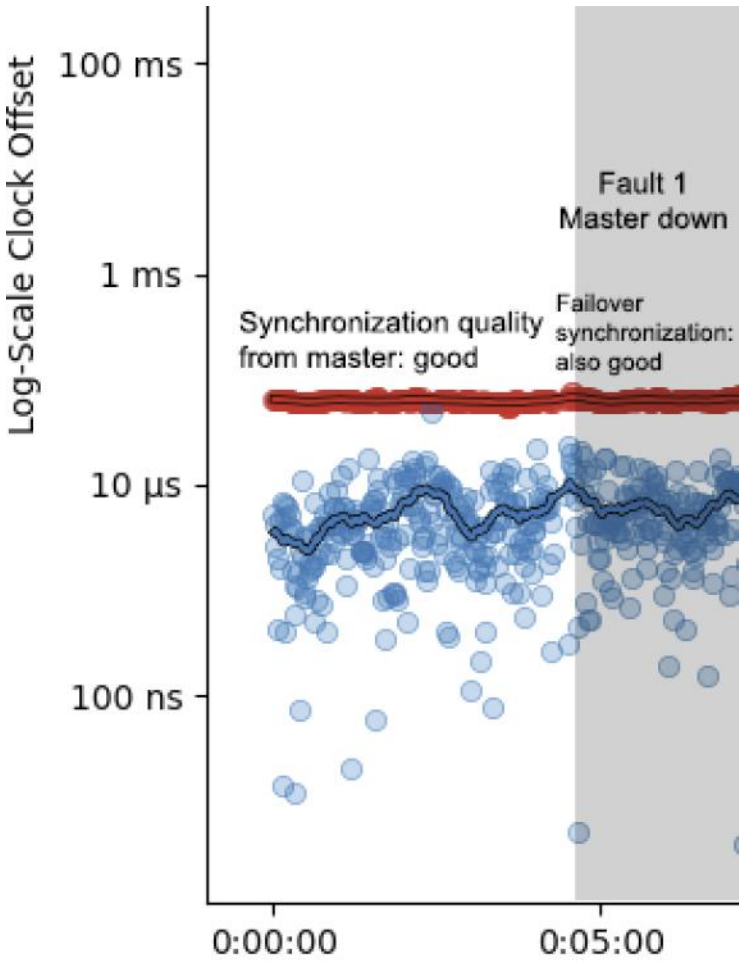
Friday, 22 March 2024 13:33

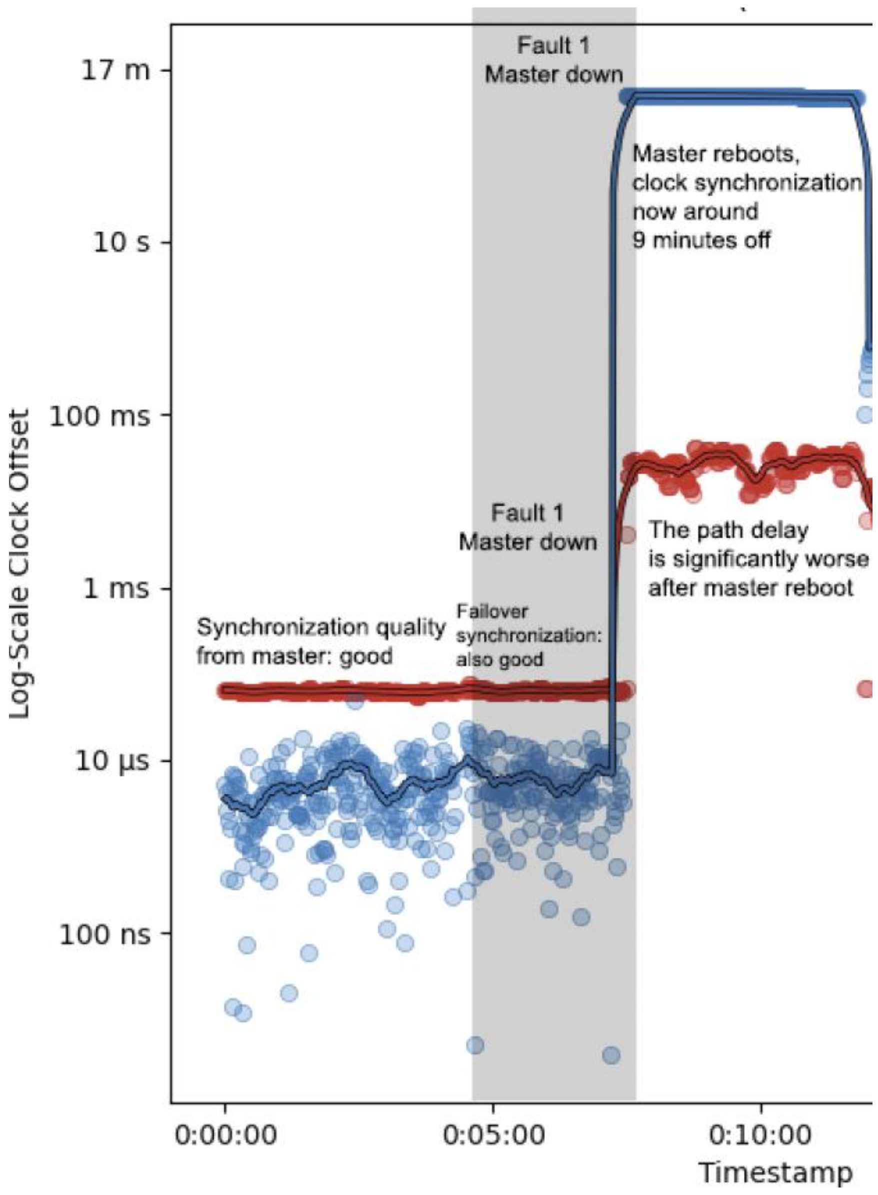
Point 2: Using a failover master

I managed to get a setup working where one Raspberry Pi acts as a failover for the master Raspberry Pi. When the master Raspberry Pi goes down, the failover Pi will switch from being a slave and become the new master source. The remaining slave will use the failover master as the new time source. This works quite well in isolation: assuming that the failover master was well synchronized with the master to begin with, when the master first fails the other slave will quite seamlessly switch to the failover master. There is no synchronization quality deterioration visible in this case.

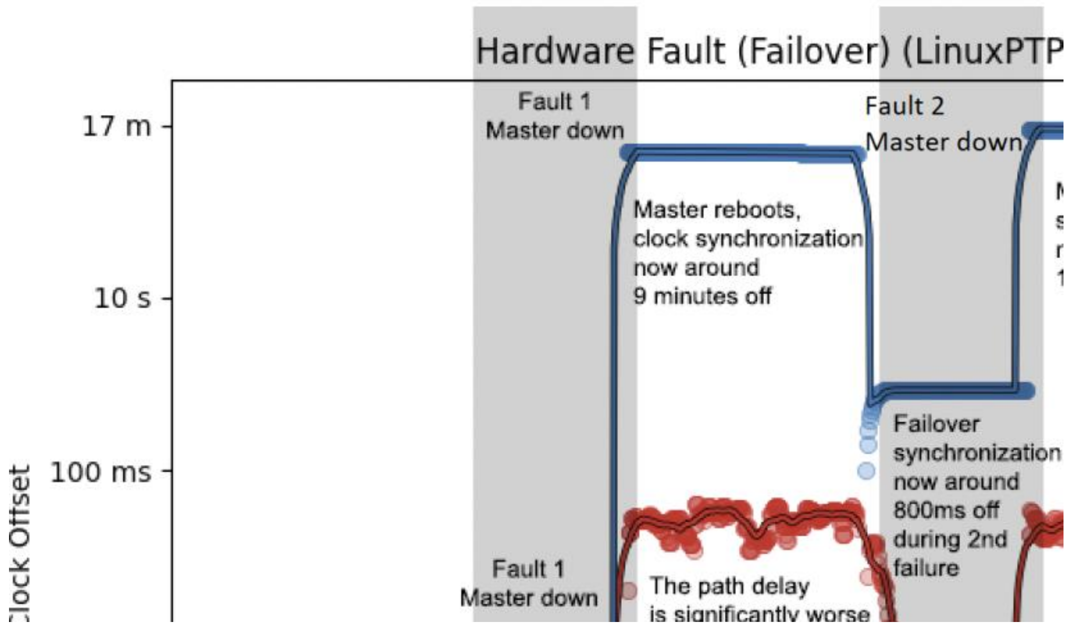
(Log scale, In blue: absolute clock offset of the slave to the master. Red: estimated path delay)

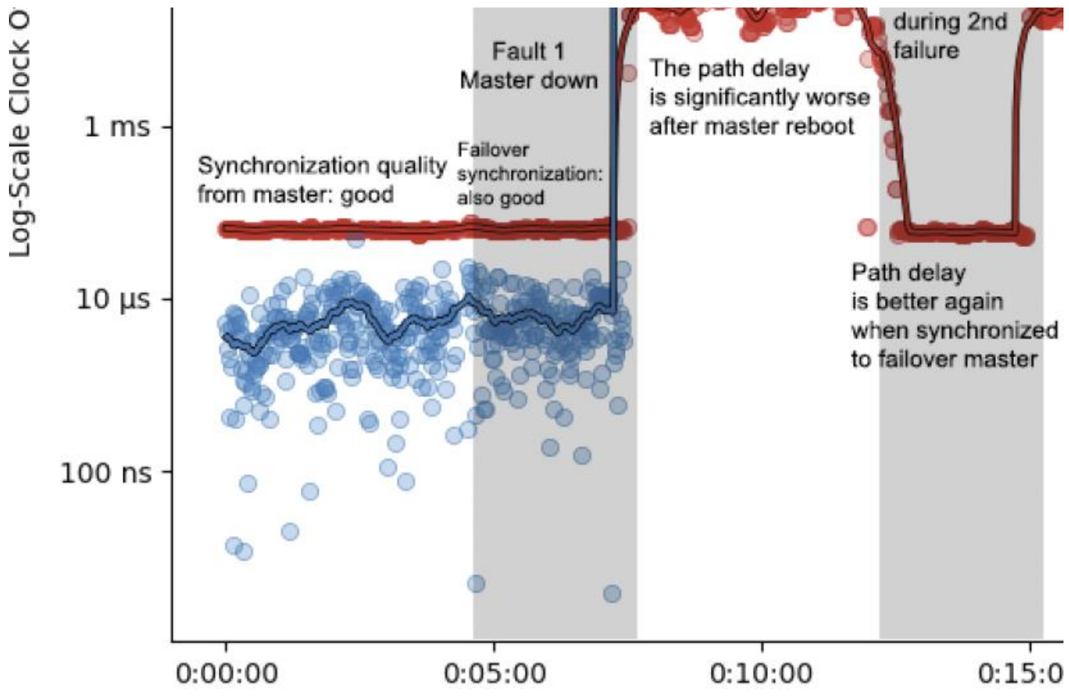


However, the problems start when the master comes back online. Like we saw in the previous scenario with just a single master failing, once the regular master node comes back online it will have a different clock due to the lack of a real-time clock.

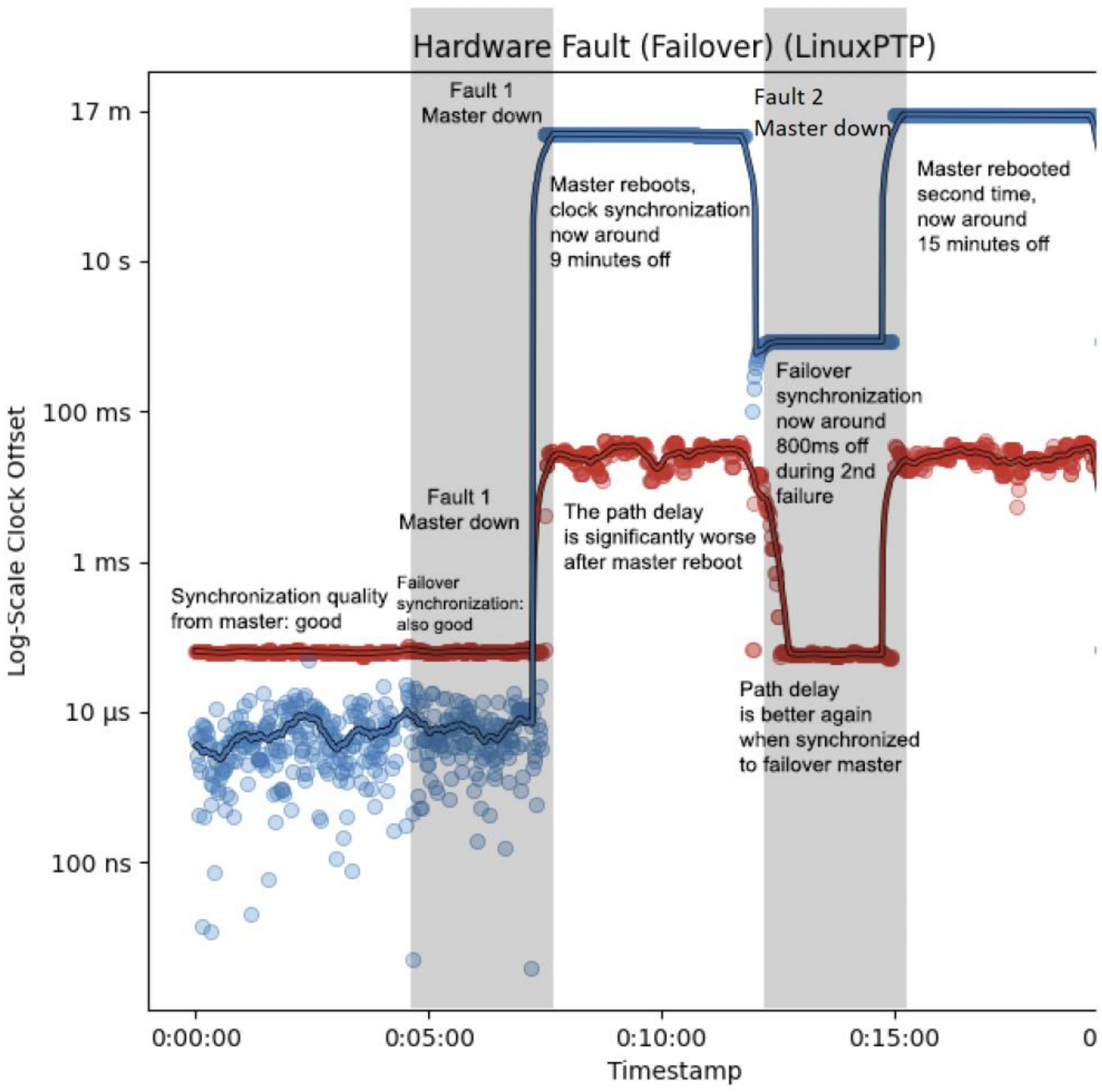


In this case there is a synchronization difference of around 17 minutes. Because the slaves are not allowed to step their clock, they are stuck slowly trying to reconverge on the master node. This process requires a long time to complete, so when a second fault occurs the failover master and the slave are not well synchronized to the master node. That means that the failover works less well and there is now an offset between the failover master and the slave of around 800ms:





Finally, upon the second master reboot, the offset is greater yet again with 15 minutes of offset:



So to summarize: A single failover in isolation works well. However, when the master with a different clock joins the network again things go wrong.

For the paper I would show once that having a master node without a true clock source is problematic in failure scenarios and then use results from the second hardware testbed instead where this problem does not occur (at least at this magnitude).